# Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Published Biweekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime, and Other Non-Metallic Minerals.

*Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, North, Central and South America; elsewhere $1 additional for each year. Single copies 20c.*

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Vol. XX CHICAGO, SEPTEMBER 10, 1930 No. 12


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*Next Issue Sept. 24, 1930*

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## National Paving Honors For 1930 Go to Iowa

### TO BUILD 700 MILES HARD ROAD

This year's honors in first-class pavement building go to Iowa which has already this year constructed 700 miles of hard-surfaced pavement of a program that embraces 1,025 miles.

At the end of every working day Iowa road builders have turned out no less than 4 miles of concrete pavement. This naturally means that there are many detours, but these detours almost without exception are in good traveling condition. However, the new pavements are being thrown open to traffic as rapidly as possible, so that little inconvenience is being experienced. Iowans speak of these detours as detours of gold, for they signify the establishment of the lowest cost, smooth motoring.

This accomplishment of Iowa is generally regarded as a remarkable achievement for an agricultural state. Altogether some $33,000,000 will be spent this year in improving Iowa roads. Although some $10,000,000 in excess of the annual income, Iowa has been enabled to foster such an extensive road program only because of the widespread adoption among counties of the bond-issue plan. So far 79 counties have voted bonds totalling $102,000,000. All this in effect constitutes a state plan, for the Iowa State Highway Commission has complete authority over all construction on primary roads. This has resulted in the paving of time-and-money-saving through routes.

Iowa is typical of the states that floundered through a long period of indecisive roadbuilding. A few years ago it became clearly evident that, if actual progress were to be made in bringing the state out of the mud, a co-operative plan would have to be adopted. Two years ago a state bond issue for $100,000,000 was acted upon favorably by the voters but it was later declared unconstitutional. Immediately the various counties began passing bond issues, turning the money over to the state for expenditure, with the understanding that later, when a state bond issue would be adopted, these county issues would be retired immediately by the state. It is believed that the next general assembly will remove all constitutional difficulties.

At any rate, Iowa this year becomes the possessor of an additional thousand miles of concrete pavement. Iowans themselves are a bit puzzled at the ease with which this is being accomplished. The money for financing the county bond issues is coming from the 3-cent gasoline tax and from the motor vehicle license fee receipts.

Already the effects of the paving program are noticeable. For instance, a recent traffic survey in Des Moines indicated that 17 per cent more motorists were coming into the city this year than did last year. General business conditions are better in Iowa than in most states and there is less unemployment. The latest business condition survey map published by the *Nation's Business* gives Iowa one of the very few "good" spots.

The Iowa story shows that the problem of providing adequate pavements is not as difficult as it may appear on the surface. Iowa is accumulating pavement without extra taxation, in fact, with only normal taxation. But Iowa is using intelligence along with cement, sand, stone and water.

## Sand Washing Opposed Residents Fear Dust

A legal controversy has arisen in North Adams, Mass., concerning a sand-and-gravel plant. Significantly this plant is owned by the mayor and the commissioner of public welfare. Its operation is opposed by the proprietor of a printing company who claims that his printing equipment and jobs are sometimes injured by dust that blows into his shop from the neighboring pit. Objection is raised against the alleged dust nuisance also by several residents in the vicinity.

A peculiar angle to this case is the fact that the complaints were filed at a hearing before the board of appeals on an application to permit the erection of a sand-and-gravel washing plant at the pit. The complainants believe that greater dust than heretofore will be raised because of the necessary rehandling of the dry pit material before it enters the washery.

## Trade Favors Pit and Quarry Among Papers

### GIVES LARGEST CIRCULATION

Once again non-metallic mineral producers throughout the world have shown their marked preference for PIT AND QUARRY as the leading publication in their industry. More producers subscribe to this journal than have ever subscribed to any paper in this field, and, what is even more interesting, they have renewed their expiring subscriptions to a greater extent than they have ever done in the case of any paper in the history of the non-metallic mineral industries.

The June 30, 1930, publisher's statement, recently made public by the Audit Bureau of Circulations, shows that PIT AND QUARRY has more paid subscribers than any other paper in the field, and that the percentage of its readers who renew their subscriptions to it is higher than that ever recorded by any paper in the industry. Such evidence of editorial leadership testifies to the wide recognition of PIT AND QUARRY'S interest and utility shown by leading producers in all parts of the world.

The editors of PIT AND QUARRY appreciate this evidence that their work continues to merit such widespread approval and support. PIT AND QUARRY'S readers, too, will be glad to learn of the ever-growing number of producers who agree with them as to what constitutes a useful and constructive trade paper. They will be pleased to know that the paper which enjoys their confidence is also the one which is read by the largest number of leading producers, both here and abroad.

## Chemical Company Buys Fuller's Earth Deposits

The Columbia Chemical Corp. has purchased the plant formerly owned by the Georgia Fuller's Earth Co., of Lumpkin, Ga., and is now actively engaged in remodeling the plant which, when completed, it is said, will have a normal daily output of 200 tons.

A power line, extending from Lumpkin to the plant, is being constructed and it is anticipated that operations will commence within the next 60 days.

## New Fibrated Asphalt Plant at Wilmington

### WILL PRODUCE MANY VARIETIES

Fibrated-asphalt products of many varieties will be manufactured at a large new plant recently located in Wilmington, Del., by the Servicised Products Corp. of Chicago, it has been announced by the Chamber of Commerce of the Delaware metropolis. Servicised Laboratories, Inc., a Delaware corporation and holding company, owns the new plant. The Servicised Products Corp. is the manufacturing concern and will operate it. The companies own and operate four other plants in Ohio, Illinois, Louisiana and Florida.

The property acquired embraces 12 acres of ground and buildings that were formerly occupied by the Standard Arms Manufacturing Co., and the Artillery Fuse Co. The new plant was located in Wilmington following an investigation of the facilities offered in the district from New York to Baltimore. Raw materials will be brought in and finished products shipped out through Wilmington's large municipal marine terminal which, in the six years of its existence, has witnessed the volume of freight increase more than 1400 per cent!

Among the products to be manufactured at the new plant are expansion joints, extensively used in the construction of highways; sewer-pipe compound, sewer liners, sewer-pipe belts; industrial flooring and bridge flooring.

## Five-Year Bibliography of Industrial Research

The increasing emphasis which is given by industries to research has induced the National Research Council, through its division of engineering and research, to compile a bibliography of selected articles from the technical press dealing with such industrial research. This compilation has been published as a 91-p. pamphlet that may be purchased at 50c per copy from the Council's headquarters, 29 W. 39th St., New York, N. Y. Among the sections devoted to special fields we note the following sections which are of interest to operators in the pit and quarry industries: abrasives, cement and concrete, chemistry, industrial chemistry, explosives, fuels, industrial gases, geology, highway engineering, illumination, lime, lubrication, machine tools, mining, and refractories.

The primary purpose of this bibliography is to supply references that will provide answers to such questions as:

1. What are the conclusions of America's leaders in research?
2. What practical results are they achieving?
3. How does cooperative effort compare with individual effort?
4. How should a research department be organized?
5. What methods do research laboratories follow in specific industries?

The title of the pamphlet is "Five Years of Research in Industry," and its compiler is Clarence J. West.

## Burton Explosives, Inc. Becomes Manufacturer

Concurrent with the filing of a deed covering 418 acres of land near New Castle, Pa., announcement is made of the entry of Burton Explosives, Inc., hitherto a sales organization, into the explosive and chemical manufacturing field. J. S. Burton, president and general manager, formerly president of The Grasselli Powder Co., is quoted as stating that an initial production of 12,000,000 lb. of high explosives in 1931 is projected.

A plant to employ over one hundred men is now under construction on the site of the former American High Explosives Co., of which Mr. Burton was general manager at the time of a merger of The Burton Powder Co. with Grasselli in 1917.

The manufacture of a line of heavy chemicals is proposed as a development to follow the establishment of the explosive line. Headquarters of the company are in the Guardian Building, Cleveland, O.

Production is scheduled to start January 1st, 1931.

## Road Congress to Meet at Washington, D. C.

The Sixth International Good Roads Congress to be held in Washington, D. C., in October will be the first meeting of its kind ever held in the U. S. and is expected to attract the largest attendance of any international roads meeting yet held. The five previous meetings of the congress have been at Paris, Brussels, London, Seville and Milan.

Road-building problems of the world will be discussed at the coming convention and delegates will share each others' problems and experiences, gaining much through the exchange of views. In nearly every land, the problem of building highways to keep pace with traffic demands has become a problem of first-rate importance. Some idea of the traffic gain in the U. S. in recent years may be gained from the fact that, since 1921, the number of motor cars to every mile of improved highway in the country has jumped from 19 to 39.

## Cement Specifications Modified by A.S.T.M.

### INCREASE REQUISITE STRENGTH

Revisions in the standard specifications and tests for portland cement, involving an increase in tensile-strength requirements and the fixing of tolerances for the various pieces of apparatus used in testing cement, have been adopted by the American Society for Testing Materials following a favorable vote by the society's membership in a recent canvass.

Eleven items in all were included in the revision, of which nine were concerned with tolerances for testing apparatus. According to the original report of Committee C-1 on Cement, lack of definite information on tolerances for testing apparatus in the former standard made it practically impossible to determine whether equipment did or did not meet specification requirements.

Revisions in the strength requirements include a change in the average tensile strength at seven days, for the three standard mortar briquets, from a minimum of 225 lb. per sq. in. to 275 lb. per sq. in.; and a change in the average tensile-strength requirement at 28 days, from a minimum of 325 lb. per sq. in. to 350 lb. per sq. in.

These revisions in strength requirements will bring the minimum values more in line with the general strength level maintained by portland cement plants throughout the country. According to the committee's report, a survey of tests by 116 plants made during the latter half of 1928, indicated that only a small percentage of the samples tested failed to meet the new standard tensile-strength requirements at the 7-day and 28-day periods.

Specifications for high-early-strength portland cement were accepted for publication as tentative by the society's Committee E-10 on standards, at its February, 1930, meeting. Tentative specifications are the same as the newly revised specifications for portland cement, except that a maximum sulphuric-anhydride content of 2.5 per cent instead of 2.0 per cent is permitted, and that tensile-strength requirements shall be 275 lb. per sq. in. at one day, and 375 lb. per sq. in. at three days. In addition, the purchaser has the option to require a test at 28 days, in which case the average tensile-strength obtained shall be higher than the strength at 3 days.

Copies of the revised specifications for portland cement, and of the tentative specifications for high-early-strength portland cement, may be purchased from C. L. Warwick, secretary-treasurer of the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa.

## No Accident for Year is Record at Petoskey

PLANT EMPLOYEES CELEBRATE

Celebrating an entire year—366 days to be exact—without a lost-time accident, employees of the Petoskey Portland Cement Co., Petoskey, Mich., recently staged a monster demonstration that was attended by over 200 of the 275 men employees of the plant. Every man was there who could be there, and even those on the night shift in the mill took turns so that each one could be present for at least a part of the celebration. The event was held on the big concrete dock at the plant, brilliant lights and a delightfully warm evening adding to the setting.

Harold Tillotson, chief electrician, ably filled the post of master of ceremonies and, as the first speaker, called on E. C. Switzer, plant superintendent. Mr. Switzer reviewed the record of the past several years. which has shown almost constant improvement and expressed as his ambition now that the plant will complete the remaining 128 days of 1930 and be entitled to one of the coveted awards of the Portland Cement Assn.

John L. A. Galster, general manager, also commended the men for their record and expressed the appreciation of the management for the interest and co-operation the men have shown in the safety work. Urging its continuance, he promised, on behalf of the company, a bigger and more elaborate celebration at the dedication of the Cement association trophy. Homer Sly, vice-president, also commended the work to date and stressed the fact that its continuance is an important matter to each individual, as a single act of carelessness would defeat the plans and ambitions of the entire force.

George John, assistant superintendent and son of J. B. John, president of the company, was the final speaker, thanking the men for their co-operation with the safety committee and adding a final word of caution that everything possible be done in order that this record may be continued through the coming months and years.

Other entertainment on the program was provided by various plant employees who demonstrated that among their number is to be found excellent and varied talent.

A luncheon arranged by a committee of the workers was served cafeteria style, concluding what many declared to have been one of the most memorable occasions in the history of the plant.

## Byron, Ill., Gravel Pit Operates to Capacity

The Ashelford gravel pit, located near Byron, Ill., has been working to capacity this summer in supplying material for the road building program in progress in this district. It is stated that Mr. Ashelford is very likely to obtain a contract for the gravel to be used in the construction of that section of Route 72 laying in De Kalb County, work on which will be commenced in December, in which event the Ashelford pit will be busy for the ensuing season.

## Huge Deposit of Onyx is Found in Montana

For many years, Montana, with its wealth of rock formations, has been producing building stone more than ample for its construction requirements, including nearly every type of sandstone and granite. Within the last two years deposits of marble have been uncovered in the vicinity of Radersburg, in Broadwater County, and these are being worked by the Vermont Marble Co.; the output being shipped to the company's various plants about the country for cutting and polishing.

Now comes the development of an immense deposit of beautiful onyx which was recently discovered in Madison County. The quarry is the property of the Montana Onyx Co. of Butte, which opened the quarry last fall and is taking out the stone in small quantities for cutting and polishing. So far, the company has only begun to develop its holdings and to prepare for the placing of the stone upon the market.

The onyx lies upon the surface in well-marked ledges, the vein having been traced over a length of a quarter of a mile. The Montana onyx, which rivals the Egyptian stone, comes in a multitude of colors which are carried out in the most beautiful tapestry designs. Approximately one hundred colors have been found by the owners of the quarry.

Joseph P. Bouchard, Henry Kiesling, A. J. Wendell and F. A. Cannon, operate a cutting and polishing plant, where they have been engaged in cutting and polishing slabs of highly colored stone for their exhibition at the industrial show, and in the mining exhibit at the recent state fair.

## Tempe, Ariz., Company Has Resumed Production

The Arizona Rock Products Co., of Tempe, Ariz., under the management of H. Douglass, receiver, has resumed operations and is now in full production supplying washed sand and gravel to the Lynch-Cannon Construction Co., which is building the new $400,000 state highway bridge across the Salt River here. Sand and gravel being available at Tempe enabled the construction company to proceed normally with the pouring of the cement required.

## Wisconsin Sand Plant Is Destroyed by Fire

COMPANY WILL RECONSTRUCT

The plant of the Eau Claire Sand & Gravel Co., of Eau Claire, Wis., was recently destroyed by fire. This is a most unfortunate occurrence, but, according to a letter from A. O. Ayres, president of the company, the intentions are to resume production as soon as it is possible to reconstruct. Mr. Ayres states that the company is desirous of purchasing an entire plant from some concern who may, for some reason, desire to dispose of its complete equipment.

The Eau Claire property had a capacity of 60 tons per hour and produced engine sand, masons' sand, concrete sand, pea gravel, concrete gravel, sand-blast sands, filter sands, and filter gravels.

Inasmuch as the entire plant was on heavy reinforced concrete substructure, it will, no doubt, be fairly easy to reconstruct using the original foundations.

The company has been in business since 1919.

## Tennessee Sand Company Builds New Storage Bins

Issuance of building permits to the Cumberland River Sand Co., Nashville, Tenn., was made August 20 for the construction of 19 steel gravel-storage bins and eight conveyors, the estimated cost of which is in the neighborhood of $125,000. This installation will constitute, it is said, one of the largest storage and shipping plants in Nashville. The contractors who share in the erection of bins and conveyors are the Stephens-Adamson Co., Aurora, Ill.; the Nashville Bridge Co., and the Foster & Creighton Co., both of Nashville.

The bins will afford storage for 15 different grades of gravel and conveyors are arranged so than any bin may be filled or unloaded independently and a conveyor will also be run to the river front for barge loading. The Cumberland company has, only recently, completed another addition, consisting of a new mixing plant, 125 ft. by 40 ft., and approximately six stories high.

## Sand and Gravel Plant Suffers $10,000 Loss

The Riverside Sand & Gravel Co., Newton Lower Falls, Mass., recently suffered a $10,000 loss from fire when the building in which the manufacture of concrete blocks was carried on caught fire. Valuable mixing machinery and other equipment was ruined by the flames.

## Weekly Car-Loadings Show Upward Trend

### 11 PER CENT IN ONE WEEK

A slight reduction in the weekly carloadings of sand, gravel and stone occurred during the last week of July and the first two weeks of August, according to the latest reports of the American Railway Assn. Carloadings of these commodities during the week ended Saturday, July 26, fell off slightly from the previous week's loadings, which were the highest recorded since October 19, 1929. A still further decrease occurred during the week ended August 2, but figures for the following week (which ended on August 9) reveal a definite upward turn which may point to a still further increase during the next few weeks. Sand, gravel and stone loadings since July 19, according to the Car Service Division of the American Railway Assn., were as follows:

| *Week Ended* | *Cars Loaded* | |
|---|---|---|
| | *1930* | *Corresponding week 1929* |
| July 26 | 63,432 | 77,770 |
| August 2 | 62,670 | 75,400 |
| August 9 | 63,360 | 74,805 |

The figures shown above bring the total number of cars loaded with these commodities thus far in 1930 to 1,343,012, as compared with 1,477,078 cars during the corresponding period of 1929, a decrease of 134,066 cars, or 9.2 per cent.

On July 31, 1930, Class I railroads in the United States had 454,815 surplus freight cars in good repair and immediately available for service, the Car Service Division of the American Railway Assn. announced recently. This was a decrease of 8,790 cars as compared with July 22, at which time there were 463,605 surplus cars on hand.

Surplus open-top cars on July 31 totaled 165,499, a decrease of 2,900 within approximately a week, while surplus box-cars totaled 232,235, a decrease of 7,149 over the same period. Reports also showed 27,014 surplus stock cars, an increase of 972 above the number reported on July 22, while surplus refrigerator cars totaled 14,744, a decrease of 461 over the same period.

## $4,000,000 Road Program Planned for Illinois

Illinois is planning to swell its 1930 road and bridge building program by $4,000,000 to aid unemployment in the state and to relieve the attendant conditions caused by the drought. The state department of public works and buildings, division of highways, has advertised for bids on road and bridge contracts to the above amount, to be received at Springfield on Sept. 10.

The contracts mentioned, according to Frank T. Sheets, chief highway engineer, are in addition to the regular 1930 road construction program and will be distributed, as far as possible throughout central and southern Illinois which has been particularly hard hit by lack of rain.

The relief work, with approximately $1,500,000 of work in northern Illinois and in Chicago's metropolitan area, will swell the state's road-building bill for the year to $37,000,000. The letting on Sept. 10 includes 159 mi. of paving, 12 mi. of grading and numerous large bridge contracts.

## Montana Onyx Deposit Rivals Egyptian Stone

During the autumn of 1929 there was discovered in Madison County, Mont., an important deposit of onyx, which, it is said, rivals the Egyptian stone in color and design. Approximately 100 colors have been found by the Montana Onyx Co. of Butte, which first opened the quarry and is taking out the stone in small quantities.

The vein lies on the surface in well marked ledges and has been traced over a distance of approximately one-fourth mile.

The company is owned by J. P. Blanchard, Henry Keisling, A. J. Wendall and F. A. Cannon, all of Butte.

## Cement Safety Meeting at Seattle on Sept. 9

Cement manufacturers of Washington, Oregon and British Columbia met September 9 at Seattle to discuss safety problems and to witness a first-aid contest held under the supervision of the U. S. Bureau of Mines. Four teams were entered.

Some of the features of this meeting were talks by representatives of the International Portland Cement Co., Spokane. This company's plant is the first in the state to operate a full year with no lost-time accidents.

## Cincinnati Corporation to Produce Foundry Sand

The Delhi Foundry Sand Co., Cincinnati, O., $50,000 capital stock, has recently been formed by H. F. McVey, J. R. Ginn, and associates who contemplate the operation of a plant to produce foundry sand and other foundry supplies.

## Material Firm Increases Lime Putty Capacity

Galbraith & Co. of Seattle, Wash., are constructing additional storage bins in order to keep pace with the increased demand for their products. Materialmen of long standing, they have secured contracts for supplying lime products for many large jobs, among which is the new $3,000,000 King County Hospital under construction on Yeslen Hill, Seattle.

## State Mineral Wealth Exhibited at Chicago

### CHIEF OF SURVEY OPENS MEETING

The Illinois State Geological Survey held an exhibit, September 2 to 12, in the headquarters of the Western Society of Engineers, Chicago, covering the wealth of mineral resources within the State of Illinois. Dr. M. M. Leighton, chief of this survey, discussed the minerals with respect to mode of occurrence, availability, production, preparation, and use, setting forth the commercial and economic value of these resources. He also reviewed the geological conditions that controlled these deposits. These addresses were delivered at 2 p. m., as follows:

Sept. 2—Illinois coals.
Sept. 3—Geological engineering aspects of coal recovery.
Sept. 4—Combustion data for buyers and users.
Sept. 5—Oil and gas resources—producing and potential areas.
Sept. 8—Fluorspar, limestone, dolomite, silica, molding sands, tripoli, ochre and Fuller's earth in the metallurgical, chemical, and agricultural industries.
Sept. 9—Stone, sand and gravel aggregate, exterior and interior building stone, ceramic clays, lime- and cement-making materials in the building industry.
Sept. 10—Geological data affecting the location, construction, and maintenance of highways, railways, transmission and telephone lines, pipe lines, etc.
Sept. 11—Geological and metallurgical data in relation to investments and litigation.
Sept. 12—Surface and underground water resources for industrial and domestic use. In co-operation with the Illinois State Water Survey.

During this symposium four illustrated addresses were delivered, at 7 p. m., by noted authorities, as follows:

Sept. 2—"What the Paleozoic submergences did for today's civilization in the great Mid-West," Dr. M. M. Leighton, chief, Illinois Geological Survey, Urbana.
Sept. 4—"Our inheritances from the Ice Age," Dr. J. Paul MacClintock, professor of geology, Princeton University, Princeton, New Jersey.
Sept. 9—"Earth movements and the accumulation of oil and gas," Dr. Cary Croneis, assistant professor of paleontologic geology, University of Chicago.
Sept. 11—"Minerals and Man," J. R. Van Pelt, Jr., curator, Division of Geology and Mineral Industries, Museum of Science and Industry, Chicago.

These programs were arranged under the auspices of the Mineral Industries Division of the Society, C. C. Whittier, chairman.

## Mississippi to Have New Portland Cement Co.

W. S. Guest, of Philadelphia, Miss., is organizing the Mississippi Portland Cement Co., which will have headquarters in Jackson, Miss. He has selected B. R. Alford, of New Orleans, La., to handle the construction, which he expects will be started on or before Jan. 1, 1931.

Mr. Alford will also be vice-president and general manager. He has not made his selection of plant equipment.

## Credit Bureau Secures Financial Information

### 26,937 VERIFICATIONS IN YEAR

The Bureau of Contract Information, Inc., is a non-profit-making, fact-finding institution, organized for the stabilization of the construction industry. Its purpose is primarily to co-operate with those responsible in the award of public and private construction contracts in order that, in so far as possible, the public may be assured of skill, integrity and responsibility in construction.

The organization of the bureau was the result of careful study of conditions in the construction industry which have in the past made for incompetency and irresponsibility, costing the public, the industry and those allied with it vast sums of money. The study of the conditions referred to goes back to the conferences in 1924 and 1925 of the committees representing the following: American Assn. of State Highway Officials; American Institute of Architects; American Institute of Consulting Engineers; American Society of Civil Enginers; American Society of Mechanical Engineers; American Society for Municipal Improvements; Associated General Contractors of America; National Assn. of Casualty and Surety Agents; and Surety Assn. of America (Committee on better underwriting).

The outcome of the above conferences was the preparation and approval of a standard questionnaire for use in connection with the award of public and private construction contracts. It also definitely recommended the organization of a national bureau for the investigation of the performance record of the individual contracting concern throughout the United States, in both public and private engineering and building construction.

Progress following the conferences towards the organization of such a bureau was somewhat slow because of the difficulty which public officials, architects, engineers, surety companies, financial institutions, those extending credit, and organized commercial credit agencies had experienced in securing information from the contracting concerns. Finally the surety companies, recognizing their part of an obligation to those responsible in the award of construction contracts and to the industry as a whole, agreed, on August 22, 1929, to undertake an experiment and they authorized the formation of the bureau.

The purposes of the Bureau are:

1. Definitely to establish the facts concerning the performance records of the individual contracting concerns throughout the United States, as developed during the last three years.
2. To carry forward the individual performance records when such facts have once been established, and as further contracts are awarded, bonded and performed.
3. To disclose verified information about the performance records of the individual contracting concerns, to those legitimately entitled to it by reason of being responsible for the award of public and private construction contracts, the writing of contract bonds or the extension of credit.

The action of the surety companies was with a definite understanding that the experiment would be entirely financed by the surety companies up to the point where it was proved that the operation of such a bureau was practical or impractical. For this experiment they appropriated the sum of $35,000, with the understanding that if, in the expenditure of that amount, it was proved that their fears were not well founded and that such a bureau could gather information which the surety company and other agencies, already mentioned, had not been able to gather, they would then renew their subscriptions and would then recommend the acceptance of subscriptions to the work and service of the bureau from others allied with the construction industry whose obligation to the public through those responsible in the award of construction contracts were similar to those of the surety companies. In the meantime, those extending credit to the construction industry would be asked to co-operate only in furnishing verification information.

After preparing the necessary forms required in the investigation, the bureau began to operate about October 1, 1929. It soon demonstrated its ability to secure information which, in point of volume, was far beyond what had ever been gathered by surety companies, financial institutions, those extending credit from the standpoint of sales of equipment and materials and organized financial credit agencies. The reason for this is that the bureau belongs to industry itself and, therefore, those affiliated with construction have an individual interest in it.

Verification information has already been received from public officials, engineers and architects on 30,590 individual construction projects; 26,937 verification replies have been received from manufacturers and distributors of equipment and materials, financial institutions and surety companies which show co-operation.

## Four Men Killed in Iowa Stone Quarry Collapse

The McManus rock quarry, located at Montrose, Ia., was the scene of an accident August 16, when the rock ceiling of one of the workings suddenly fell, crushing four men to death under tons of rock.

## Manufacturers' Annual Meeting, Sept. 18-19

### FIFTH MEETING OF ASSOCIATION

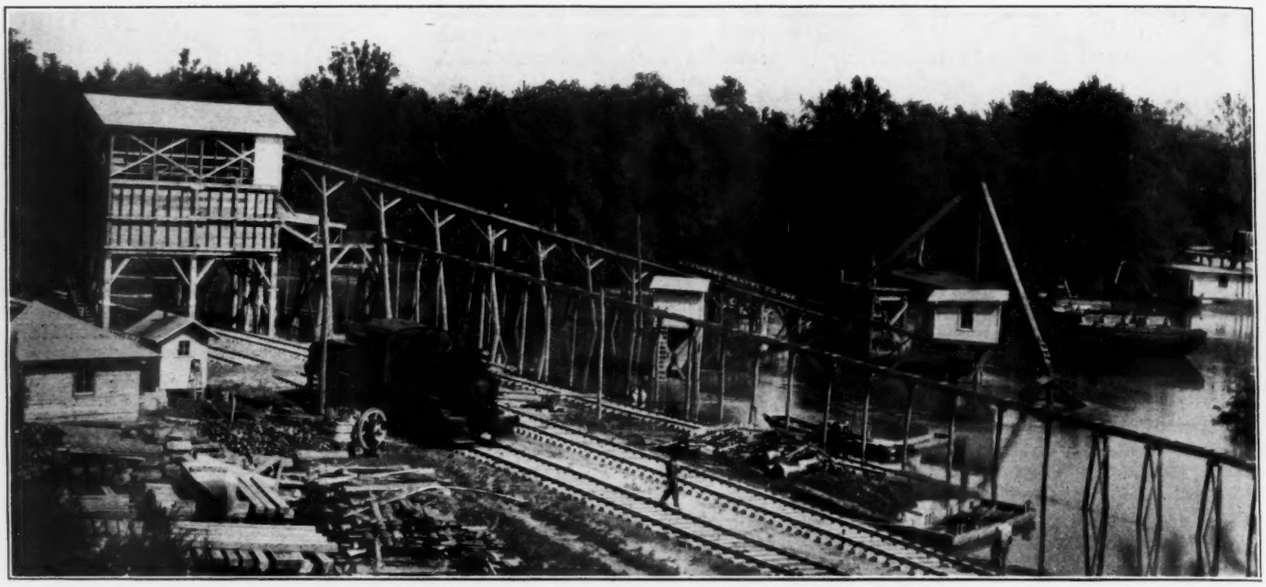
The Manufacturers' Division of the National Sand and Gravel Assn., will hold its annual meeting at the Stevens Hotel, Chicago, Ill., on Sept. 18 and 19. This gathering will open with a dinner on Sept. 18, at 6:00 p. m., and the sessions will continue through the following day. A number of members of the association have signified their intention to be present at this meeting. Plans will be made for the exhibit of machinery and equipment, which will be held in conjunction with the Fifteenth Annual Convention in St. Louis next January, and further work of the Division will be outlined at this meeting. As is well known, four years ago the association inaugurated the custom of holding a machinery and equipment exhibit in conjunction with the annual conventions of the industry it represents. Its fundamental purpose has been to furnish manufacturers with an opportunity, under the most favorable circumstances, to bring their products to the attention of the executives and operating men of the business; and this has involved giving the representatives of the sand-and-gravel industry an educational advantage which they could not have obtained in any other way.

The success of the first exhibit, both from the standpoint of the manufacturer and the producer, was so evident that the exhibit was installed as a regular feature of the annual conventions.

## Paul, Sheffield & Paul of Arizona Reorganize

The firm of Paul, Sheffield & Paul, operating the limestone quarry at Puntenney, Ariz., has been reorganized under the name of the Sorey Lime Co., a corporation, and will proceed with the development of a new quarry near Perkinsville. Reorganization was effected early in August at Douglas, according to C. F. Harmon, c.p.a., retained by the company. The officers of the new corporation are Alfred Paul, president; Alfred Paul, Jr., vice-president, and John T. Sheffield, secretary and treasurer.

The former company leased the Puntenney property from M. B. Hazeltine, president of the Bank of Arizona, and his associates. The company made a careful investigation of the lime deposits near Perkinsville and, as it developed that production would probably cost $2 less per ton, it was decided to concentrate on the new property exclusively. This decision led to the organization of the new corporation, which will maintain general offices at Douglas.



Plant as viewed from southeast. Derrick, barges and towboat at right.

# Unusually Well Designed River Plant Uses Diesel-Powered Dredge

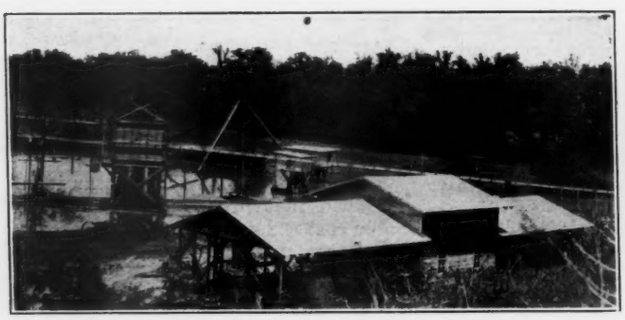
## Flooding of Ouachita River Delayed Opening of Plant More Than Two Weeks

MOST sand-and-gravel plant operators have rather clear conceptions in their minds of the type of plant they would like to build and operate. The majority of them, however, because of lack of funds, uncertainty of deposit, uncertain demand or other good reasons, build their plants as cheaply as is commensurate with economical operation, regardless of the length of time the plant is expected to operate.

J. W. Sanders, president of the Standard Gravel Co., Inc., operating a plant at Antoine, Ark., is an operator of long experience in that state and in its neighbor to the south, Louisiana. He decided some time ago to build a plant which would be his conception of an ideal plant. Searching for a suitable gravel deposit for such a plant as this, he found it in the Ouachita River near Camden, Ark.

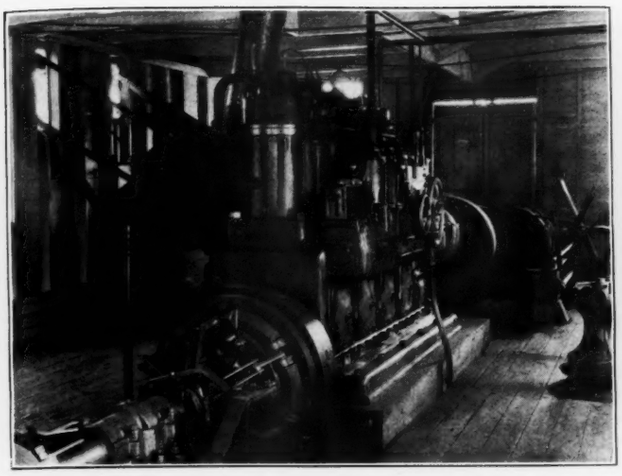
The river at this point averages about 200 ft. in width at lock-water stage and varies from 6 to 30 ft. in depth. The bed of the river is almost all gravel with large bars at the inside of almost every bend. Some of these are so large as to render the river unfit for navigation. The U. S. Government calls it a navigable stream although there is no navigation beyond Camden. Mr. Sanders therefore secured from the government dredging rights for 7 miles in each direction from the plant which is located one mile north of Camden. The deposit averages about 35 per cent sand with very little gravel over 2-in.—almost ideal for the trade to which this plant caters.

Erection of the new plant was begun in July, 1929, and everything was built to the design of Mr. Sanders who also supervised its construction. All foundations are of concrete, reinforced and tied, except for a few of the bents supporting the conveyor. These are of piling because of their proximity to the water's edge. The tug boat, dredge and un-

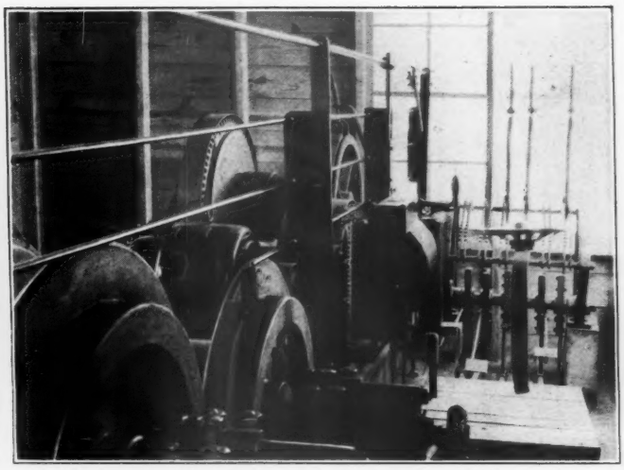


Plant, with office in foreground.

Barges and derrick, with plant in background.



Diesel engine and 4-drum hoist on dredge.



One-drum hoist which swings derrick boom, and motor.

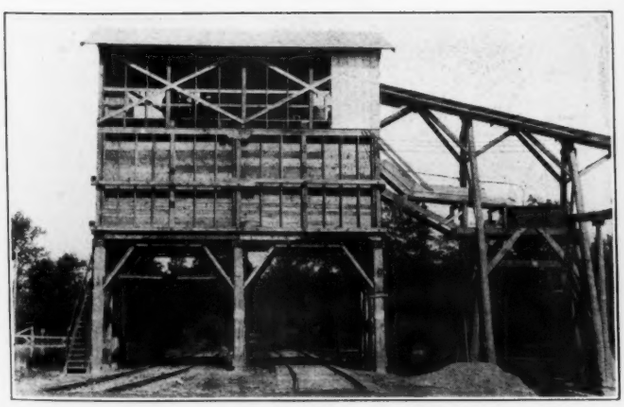
loading derrick also were designed by Mr. Sanders and no expense was spared to secure the best. The plant has a capacity of 150 tons per hour.

The plant was ready to operate early in May and test runs had been made which proved that everything was in good running condition. Then, a few days before operations were to have begun, a typical Arkansas deluge of three days' duration raised the river over its banks to a flood stage of over 43 ft. The plant was designed with this condition in mind, however, and no damage resulted other than a deposit of silt and sand on the dock and the washing out of some ballast on the switch track to the plant.

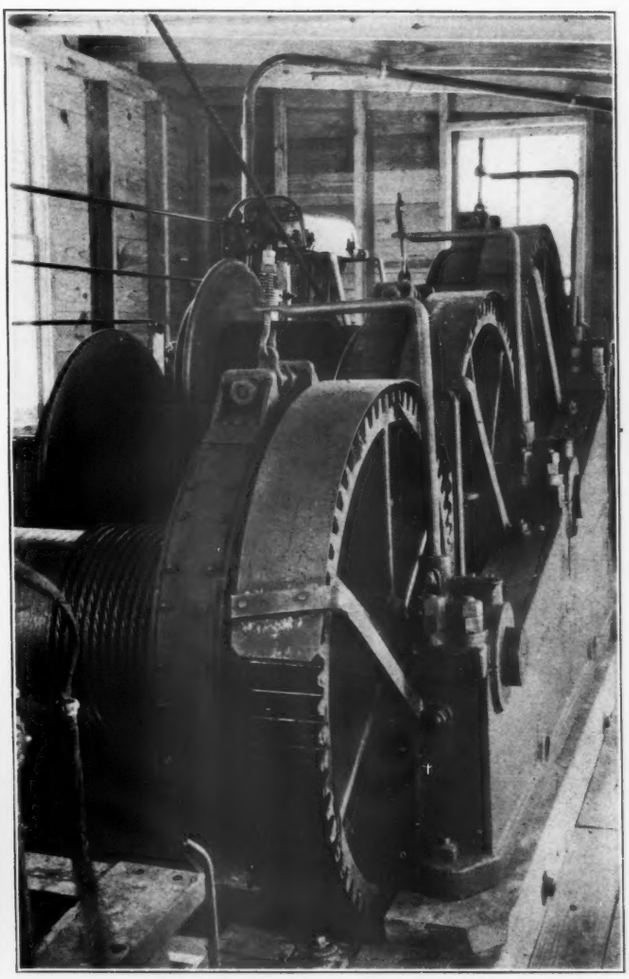
The dredge has a wooden hull, 30 ft. wide by 60 ft. long, with a wood-framed superstructure. The 10-in. Amsco Type H heavy-duty centrifugal dredge pump is direct-driven by a Fairbanks-Morse marine-type, 4-cyl., 140-hp., full-Diesel engine through a flexible coupling and a Hill clutch. The drive shaft, in addition to the Amsco water-cooled bearing at the pump, has Hill bearings near the engine. The engine and pump are cribbed up, below deck from the hull, in such a manner as to eliminate vibration.

The 40-ft. intake is supported from a steel boom handled and swung by a Clyde 3-drum hoist. U. S. Rubber Co. suction hose and Leschen cable are used. The pump, which is of the top-discharge type, discharges through the top of the dredge into a steel-lined settling box. This discharges—through a swinging steel chute—into barges at the dock.

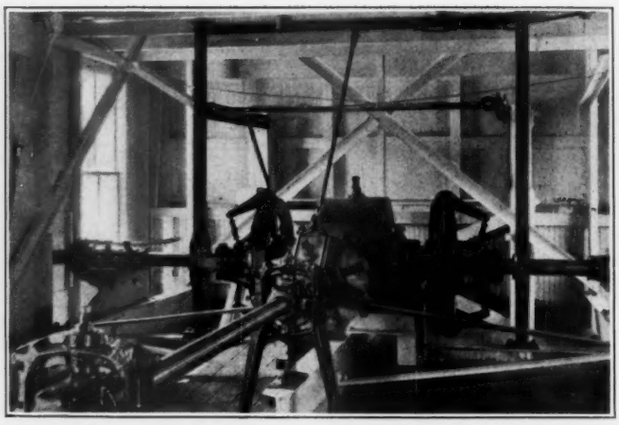
Everything on the dredge is driven from the Diesel engine. A drive pulley operates several line-shafts from which the machinery is driven through Manhattan Condor belting. A 3-in. Union centrifugal pump furnishes water for priming the dredge-pump and for cooling bearings and it can be used also in case of fire. A 4-drum Street Bros. hoist at the rear end of the dredge handles four shore



Showing screening plants and three railway tracks.



Three-drum hoist for derrick and bucket, with control above.



Friction clutches and chains in drive for tugboat paddle-wheel.

The hoist and 10-in. pump on the dredge.

lines. This hoist is operated through a clutch on the line-shaft so it can be operated only as needed.

The air for starting the engine is furnished by a compressor integral with the engine and is stored in two tanks. A small Fairbanks-Morse air compressor driven by a 3-hp. gasoline engine is used as an auxiliary. The fuel-oil tank has a capacity of 750-gal. There is also a Brown Instrument Co. exhaust-temperature indicator which can be adjusted for any cylinder and a small Delco Light plant for illuminating the dredge. The dredge was designed

Dredge, from rear.

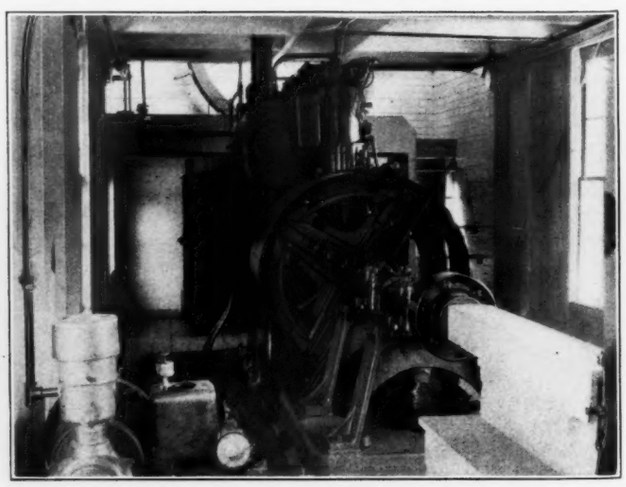
by Mr. Sanders with the assistance of Bradley Carr of the American Manganese Steel Co.

The towboat, also designed by Mr. Sanders, is of wooden construction throughout. It is powered by a Fairbanks-Morse full-Diesel engine, through a Keck-Gonnerman enclosed gear with two friction clutches and a double-chain drive to the stern paddle-wheel. A small Fairbanks-Morse air compressor furnishes air for starting the engine. The boat is operated by controls from the pilot-house at the bow. The tow-boat hauls the barges, one at a time, to the dock at the shore plant. Three wooden barges with a capacity of 200 tons each are used.

The barges are unloaded at the dock by an American Hoist and Derrick Co. 80-ft. boom, timber, stiff-leg derrick. A National 3-drum hoist, driven by a 75-hp. General Electric motor, handles the boom and the 1½-cu. yd. Williams Favorite clamshell bucket. The boom is swung by a single-drum Flory hoist driven by a 7-hp. Burke electric motor. Both hoists are in a neat frame hoist building from which one man controls all operations of the derrick. Each leg and the most of the derrick are on concrete foundations. Because of the soft ground near the river the derrick has a concrete foundation 12 ft. deep by 12 ft. square on top of eight 35-ft. piles, while the stiff-leg nearest the river has a foundation 6 ft. square by 12 ft. deep set on four piles.

The bucket handles the material from the barges to a steel-lined wooden plant hopper. The boom of the derrick is kept at a 45-deg. angle where it has a reach of 56 ft. 6 in. This is the distance from the mast to the outer edge of the barge at the dock and from the mast to the center of the plant hopper.

Derrick boom, hopper, and conveyor to plant.

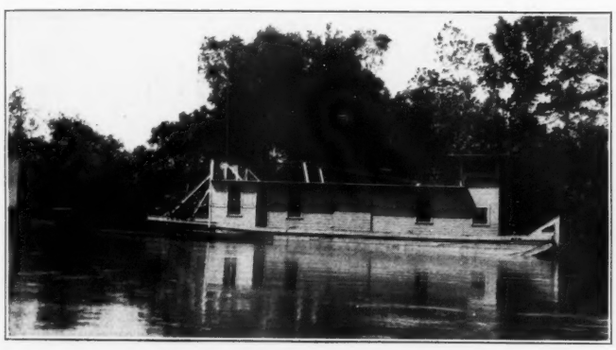


Gasoline-driven air compressor (left), Diesel engine and clutch, on tugboat.

in unloading, circular cuts are made through the barge, moving it gradually downstream away from the hopper by winches until it is unloaded. By this method the boom need not be raised or lowered during the entire operation, speeding up the unloading considerably.

The hopper discharges through a rack-and-pinion gate onto a 20-in. inclined belt conveyor on 179-ft. centers, perpendicular to the dock. The conveyor has Goodyear Style W belting and is gear-driven by a 15-hp. General Electric motor. Conveyor pulleys, idlers and drive gears were furnished by the Link-Belt Co. A feeder will later be installed under the hopper.

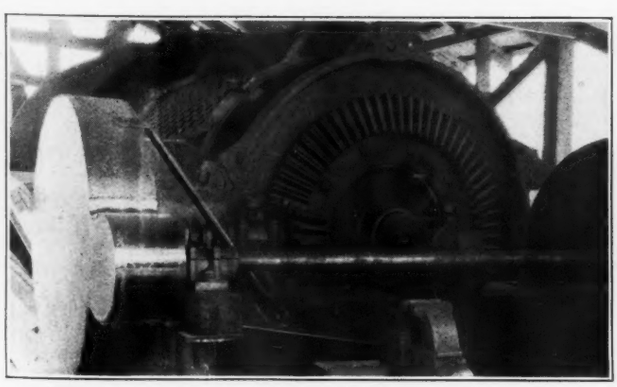
The conveyor discharges into a novel chute arrangement at the plant. Two special steel chutes were made, either of which can be installed at a moment's notice. One of these discharges vertically downward into cars for loading ballast. The other discharges into the Telsmith 60-in. by 16-ft. heavy-



The Diesel tug "Ashton."

duty revolving screen. This has three sections of 2-in., 1½-in., and ¾-in. round perforations, respectively, on the main barrel and two 4-ft. Rolman manganese sand-jacket sections with ⅜-in. mesh. The screen is driven by a 15-hp. General Electric motor and is controlled by a push-button magnetic switch of the same make.

The two sizes of gravel produced go direct to two wooden bins with a total capacity of 300 tons. There is very little oversize (over 2-in.) and this is



Heavy-duty sizing screen and sand jacket.

Pipe threader, edger and band-saw in the machine shop.

wasted at present. Later a small crusher which is now on hand will be installed. The material under ⅜-in. goes through a steel-lined wooden flume to a Telsmith No. 8 sand-settling tank. The sand drops directly to cars on a track below, while the fine sand, silt and water go through a wooden flume back into the river. The bins discharge through quadrant gates into cars on two tracks.

The flume to the sand tank is on a very gentle slope except for a short section, about 15 ft. from the tank, where it has a much steeper slope. The purpose of this dip is to allow the installation of a stationary screen to take out pea gravel whenever there is a demand for it.

The wash-water for the plant is furnished by a Fairbanks-Morse 8-in. centrifugal pump in a water-tight concrete well on the bank of the river. The pump is at the bottom of the well, 24 ft. below high-water level, and is belt-driven by a 40-hp. Western Electric motor at the top of the well. The intake pipe of the pump runs about 90 ft. on a slope to the center of the river. This type of well was designed because of the frequent variation in river level and it insures a supply of water at any level. The suction lift is only 12 ft. while the discharge lift to the

T. L. Houston, office manager (left), and M. Stodder, plant superintendent.

(*Continued on page 42*)

# Excellent Materials-Handling Example Found in New York Plant

## Pneumatic Equipment Used Successfully by East River Sand-lime Brick Company

By H. J. LEVINE
Vice-President, National Brick Corp., Long Island City, N. Y.

DURING 1929 the National Brick Corp. placed in operation an eight-press plant for the production of sand-lime brick, at Long Island City, N. Y. The capacity of 200,000 bricks per 9½-hour day makes this one of the largest producers in this country, and the modern design has permitted incorporation of the most recent improvements in methods and equipment.

The plant has frontage on the East River, to permit arrival of raw material by barge. The material flow is at right angles to the river frontage, to bring finished storage to the street end of the location, from which the brick is distributed by truck to the metropolitan market.

Sand is purchased in bulk in barges, and is unloaded by a crane with clamshell bucket. Between the arrival of barges a crawler crane keeps working the sand back toward the covered storage space adjacent to the end of the building, to provide continuous feed to the two elevator boots. The two elevators raise the sand above the level of the hydrated lime storage bins and discharge to an inclined belt conveyor. This inclined conveyor feeds a reversible belt conveyor which runs over the four sand-storage bins, to discharge at any particular bin, as required. Outdoor storage and mechanical unloading of the sand offer no particular disadvantages, since the material is little affected by weather conditions, and the dust loss is not serious.

Railroad float at dock.

Lime-storage silo, and sand storage.

The lime, however, presents a more difficult problem and, of course, requires much more care in handling and storage than the sand. In order to protect the material from the weather, to cut down unloading labor, and to reduce dust loss, pneumatic handling was selected for this application. A high vacuum system, operating at a negative pressure of 18 to 20 in. of mercury, was recommended by The Dust Recovering & Conveying Co. of Cleveland, and one of their 3-B conveyors was installed.

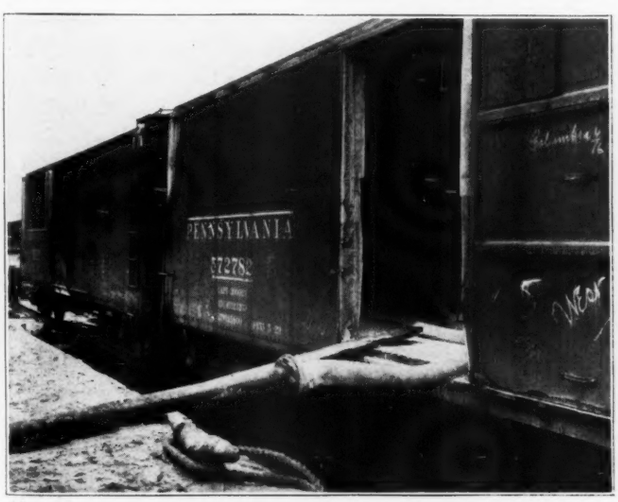
The lime is shipped in box cars from Bellefonte, Pa., and a railroad float or barge with four cars is moored at the company dock on the East River. Demurrage on the cars and float is a considerable item, so it is desirable to unload the four cars, a total of 120 to 160 tons, within the 48-hr. period allowed. The maximum capacity of the pneumatic conveyor is ten tons an hour, and an average capacity of somewhat less than that figure is now attained. The original recommendation called for an inclined pipeline, supported by bents, from the receiver direct to the end of the existing line; but in order to eliminate the supporting bents, the pipe-line was installed along the vertical wall of the building, and along the horizontal dock surface. This, of course, has increased the friction

loss through the somewhat longer pipe and the additional 90-deg. bend. The capacity of the present system is ample, however, since it is run continuously from the time the float is tied up until all four cars are unloaded.

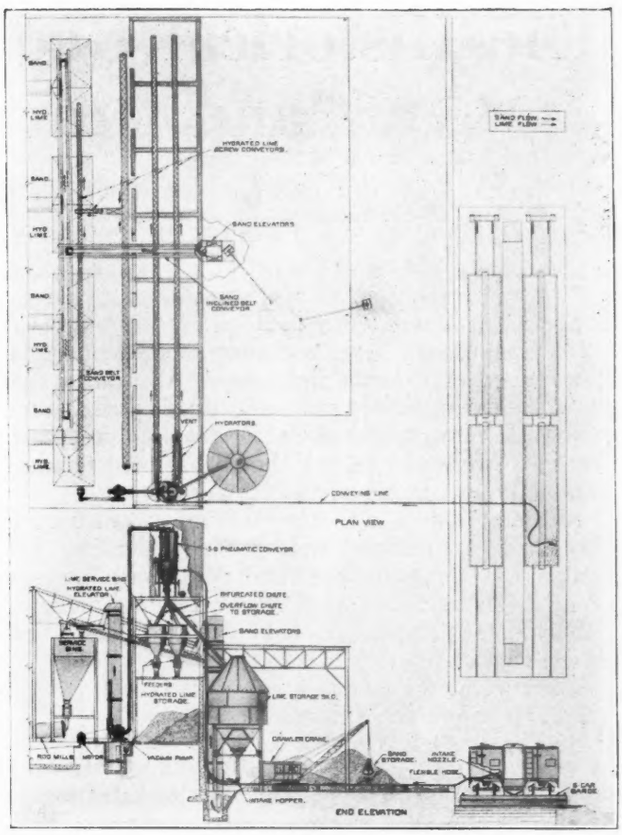
The receiving station is mounted above the hydrator bins, which are fed by a bifurcated discharge chute under the rotary discharge lock. The gravity line to the lime-storage silo is connected under the lock, above the divided spout. The vacuum pump and 50-hp. motor are located conveniently on the lower floor level, close to the boiler room. To start unloading, one length of the 3½-in. intake pipe, and the 3-in. flexible hose and intake nozzle are attached to the end of the pipeline on the dock. The last length of pipe must be detached between unloading periods, to provide a 20-ft. space for roadway along the face of the dock. The vacuum pump is started, and the 2-hp. motor which drives the discharge dock. The operator forces the intake nozzle into the material, and the unloading is under way. After the first car has been unloaded, the hose is led through this car to the one on the second track, so that two cars can be unloaded before it becomes necessary to relocate the float for the second pair. The lime is conveyed at high velocity through the pipeline, is precipitated in the receiver, and discharged in a regular flow through the air lock. There is no loss of dust in the transporting of the material, because the conveying air is exhausted through the three filters mounted above the receiving station. All the fines are collected on the inside of the filter bags, and are precipitated regularly by an automatic, compressed-air-actuated cleaning mechanism.

The combined capacity of the two hydrators is about four tons per hour, so the material comes in more rapidly than is required for process. This overflow is automatically cared for by the gravity chute to the storage silo, which draws off the incoming lime when both hydrator bins are full.

After the four-car float is unloaded, the flexible hose and final length of pipe are disconnected from the long intake line, and the intake line connected with the hopper underneath the 100-ton storage silo is opened up. This is regulated to reclaim slightly more than the 4-tons-per-hr. hydrator capacity, so that the overflow will return to storage, and the entire operation will be automatic. The labor saving over mechanical methods is obviously a great advantage for, during the period when a barge is being unloaded, two men can handle the whole job and, while lime is being drawn from storage, the only attention required is daily lubrication and inspection.




Operating flexible hose in car.




Arrangement for handling lime and sand.

The reclaiming line is led from the intake hopper under the silo, up the side of the building parallel to and finally joining the first intake line. The pneumatic receiving station and discharge lock are located in the raised housing, and the adjacent lean-to covers the two hydrators.

Each of these hydrators discharges through a double-paddle conveyor to a screw conveyor which runs over the row of hydrated storage bins. From this intermediate storage, the hydrated material is raked to a screw conveyor on the lower level, which collects the lime to the elevator boot. This elevator discharges to a short screw conveyor which, in turn, feeds the reversible screw conveyor which discharges the hydrated lime to the four service bins, as required.

Volumeter feeders under each set of sand and lime service bins proportion the materials and provide discharge to the four rod mills, which discharge the pulverized and mixed product through individual elevators to the material hoppers over the presses. Each material hopper supplies one press, from

(*Continued on page 44*)

# The Historical Geology of Glacial Sand and Gravel Deposits

## The Genesis of Terminal Moraines, Terraces, Kames, Deltas, and Eskers

By HAROLD O. WHITNALL
Professor of Geology, Colgate University, Hamilton, N. Y.

AS Commander Byrd's planes zoomed over the ice-covered lands and seas of Antarctica, the observers looked out and down upon a scene not unlike that which a large portion of North America presented during that phase of geological history known as the Great Ice Age.

Although this age of ice was, measured by the standards of human history, very remote, yet against the background of hundreds of million years of earth history, its antiquity of a few hundreds of thousands of years makes it but a few minutes ago as the geological clock marks time.

A glance at the glacial map (Fig. 1) shows the extent of the ice cap which occupied all of Canada and extended in a broad tongue into the United States. It also shows that the ice sheet did not originate in the Polar regions, but had its origin in three localities, all of them considerably south of the Arctic Circle. Greenland is thought to have had its own ice cap which it still retains.

Why such vast centers of ice accumulated in regions 35 degrees south of the pole is not known. Many conjectures and theories have been put forth; such as a continental uplift carrying this region to altitudes above the snow line; to a shifting of the poles; to changes in the courses of ocean currents; to astronomical reasons; to the presence of a large amount of volcanic dust in the atmosphere which, serving as a blanket, would filter the sun's rays, causing a lowering of the mean temperature sufficient to change the regions into great snow fields; to a slight increase of carbon dioxide in the air, which might produce a moist, cold climate. These and many others have been suggested, but objections have been raised against them all.

*Throughout our northerly states the majority of the sand deposits and gravel deposits that have been or are being commercialized were created by glacial action. The accompanying discussion by an eminent geologist presents information of prime importance to many operators. Perhaps the scientific but simple explanations will prove useful in elucidating certain puzzling phenomena that have been disclosed in natural deposits.*

*This article was published originally as three installments in the* National Sand and Gravel Bulletin. *It is to be published soon by John Wiley & Sons in book form, bearing the title "Sand and Gravel," by Harold O. Whitnall and H. Eltinge Breed. The present reprinting is made with permission from the publishers and a release of the copyright by Professor Whitnall.*

*The final installment will appear in an early issue.*

### The Coming of the Ice

Whatever may have been the contributing factors, the climate was colder then than now and, in at least three regions of northern Canada, great snow fields were developed. Since the precipitation was greater than the evaporation, the snow became very deep. In time the pressure from the ever-accumulating snow blanket began to transform the older and more deeply buried snow into ice granules which under still greater pressure massed themselves into sheets of ice. Though ice appears brittle, it possesses many of the properties of a viscous body. Thus, as the ice bases of these snow fields thickened, the ice radiated from the centers and coalesced to form a gigantic ice cap, which, in turn, spread outward in all directions.

At first the movement of the ice sheet was influenced by the topography of the surface on which it rested but, as it grew in thickness, covering the hills and valleys to a depth of several thousand feet, its movement became independent of the underlying terrain and it rode majestically over hills and even small mountains, pushed onward by the fresh supplies that were being accumulated in the areas of intense blizzards.

It crept to the north, perhaps to join a polar glacier. This we do not know. It moved to the west until the lofty ranges of the Cordilleran region blocked its path. It swept eastward into the Atlantic where freed from its foothold on land it broke up into great icebergs. It pushed southward, blanketing entirely or in part what are now twenty states of the Union. Even in this tongue that extended into the United States the ice was very thick. It covered the mountains of New England and engulfed the Adirondacks and Catskills.

It is the southern and southeastern extension that is of the greatest interest to us. The continental ice sheet was halted in its march to the east and southeast by the Atlantic. In the south its progress was checked by a warmer climate which melted the ice front. For some time the battle between the advancing ice and the warm southern climate vacil-

lated with neither side the winner. The mild temperature, melting the marginal areas, caused temporary recession of the ice. But, far away to the north, new ice was forming which kept shoving the older ice southward, thus replenishing the loss along the melting ice front.

Finally there came a time when the genial climate prevailed and the ice field melted, giving up the long ice-bound territories and vanishing in great rivers of ice water pouring from the continually melting ice front.

This "thumb-nail" sketch of the birth and death of the Great Ice Cap has omitted many details of the climatic conditions prevailing at the time, but is sufficient to give a general idea of the situation.

### The Pre-Glacial Land

Now let us see how the life history of the continental ice sheet modified the areas which it invaded. Let us look upon the land as it was before the ice came.

For many millions of years before the coming of the glacial climate the North American continent, in common with the rest of the world, had been enjoying a mild, genial climate. Even as far north

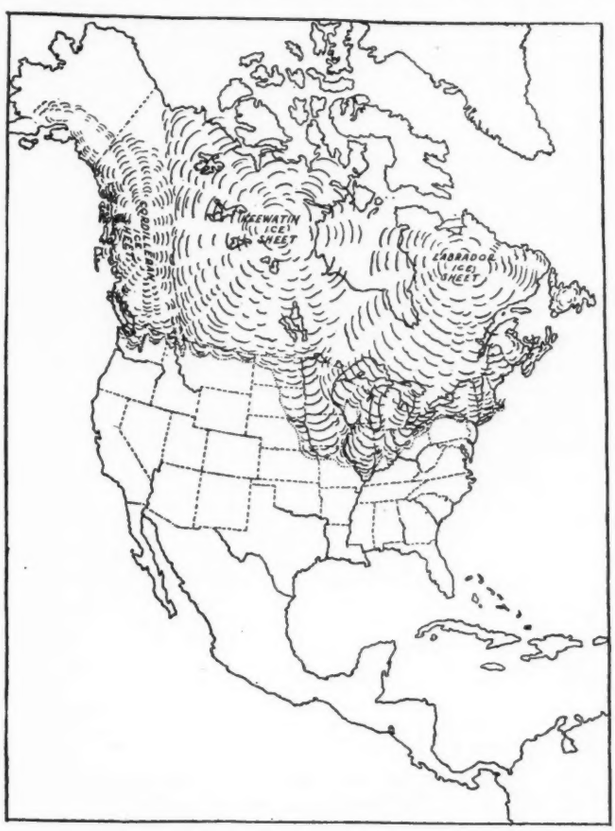



Fig. 1. North America during the Great Ice Age.

as Greenland there are found, in the beds laid down previously to the ice age, fossils of a luxuriant, subtropical flora such as the evergreen oak, beech, poplar, maple, lime, magnolia, as well as the giant sequoia, which now flourishes in California.

During this long period the weathering agents had disintegrated and decomposed the surface rocks to a great depth and the soil mantle lay deep over the land. Then, as now, the surface rocks were of a varied nature. In Canada the rocks are very ancient and can generally be classed as granites and gneisses. In the United States, especially in the area of glaciation, the surface rocks are of the sedimentary series, such as sandstones, limestones, shales, marbles, slates and quartzites. The Adirondack mass, as well as certain areas in the New England States, and the Lake Superior region, are exceptions and may be, for general purposes, classified with the old rocks of the Canadian Shield.

It is of great importance to understand this varying pattern of the earth's crust which was covered by the glacier for, as we shall see, these rocks are the source of the great sand and gravel deposits that now occur in the glaciated region and just beyond its border.

### The Ice Plow

When the centers of the snow fields had accumulated enough ice to cause it to be squeezed outward, it moved over this ancient soil-covered land as a great plow. Manifestly if the ice merely shoved the loose soil ahead of it, it would very soon accumulate such a massive ridge of pushed material that it would serve as a great barrier.

But the ice sheet not only shoved some soil ahead, but it continually incorporated it into its icy bosom. Soon the ice, or at least the lower portions of the ice, became a storehouse of frozen soil. It is important that this fact be stressed, for in no other way can the vast amount of transported detritus be accounted for.

Ice itself has little erosive power. In a pure condition the ice would be unable to deepen valleys, to tear loose rocks from ledges, or to plane off the soil down to the bed rock. Keeping in mind, however, that at a very early stage in the ice movement the glacier was undershod with frozen debris, one can readily see that this material held in the clutch of the ice served as a great file or plane that plucked, abraded and scoured the underlying ground down to the very bed rock.

Evidence of this scouring action of the ice is abundant. Many rock surfaces show a smooth surface, scratched and sometimes grooved. These markings, caused by the large stones that were embedded in the bottom of the ice, indicate the direction of the ice movement. In the United States these markings all run in a southerly direction save where large topographical features like the east and west Mohawk Valley have locally influenced the ice movement.

Aside from these scratches on the rock floor we find the stones that served as the teeth of the glacial file are also scratched. The scratches on these loose pebbles are mainly in the direction of their longest diameter, a phenomenon which would be expected when one realizes that a stone held in the frozen grasp of the ice and at the same time digging into the underlying rock would be forced into such a position as to move along the line of least resistance. The presence of a scratched or furrowed rock floor and the scratched stones that served as tools are indicative of glacial action.

### An Agent of Transportation

It is apparent that the glacier was a great agent of transportation, the greatest of all the geological forces. Although rivers carry an immense amount of material, especially when their volume and velocity is great, they cannot compete, as carrying agents, with a glacier. The amount that a glacier can carry is limited only by the bulk of the ice, while the carrying power of a river is dependent upon its velocity and volume.

To give an idea of the ability of ice to carry large boulders the following illustrations will be given. A granite boulder of about 8,000 cubic feet and weighing about 700 tons lies on the western slope of Hoosac Mountain, at least 1,000 feet above the valley over which it was transported. In Essex County, Mass., there are a large number of great boulders that came from the White Mountain region over 100 miles away.

Plymouth Rock is a glacial pilgrim, long antedating the coming of the Mayflower. In the report of the Geological Survey of New Jersey for 1880, there is a remarkable statement concerning a mass of limestone which had been quarried for years without anyone suspecting it was a boulder. To quote from the report: "As exposed it measures thirty-six by thirty feet, and the quarrying has gone twenty feet in depth." This boulder is near Drakestown, a thousand feet above the sea and a number of miles southeast of its native outcrop.

These illustrations, dealing as they do with the larger masses transported, are indicative of the vast amount of finer material that the glacier carried, often, for long distances. The ice sheet contained a great assortment of sizes and kinds of rocks. Moving, as it did, over a soil-strewn country, it scooped up all loose material that littered the land. Hillside soils, and the sands and gravels of the old river courses, the angular debris of mountain tops, great boulders from rocky ledges, clays from ancient shallow lakes—all these the relentless ice took into itself and carried onward.

Here it rode over a limestone ledge, there a sandstone, at another place it scooped up soft shale, in some other place it wrenched great granite boulders from their age-long home. Plucking, filing, grinding, prying and scooping, it seized all these sizes and types and locked them into its ice-lined prison.

Here it put those fragments which were at the bottom to work. They, which had been seized, were used to scour, scrape and to rip up new material as the ice swept over new lands. In turn they were replaced by new fragments. In such a way the workers for the ice were continually replaced.

When one realizes the enormous pressure exerted by the ice on the underlying rock, it is readily seen that these tools wore out very fast. It is estimated that each 1,000 feet of ice exerted a pressure of 25.5 tons to the square foot. The tremendous pressure of a five-thousand-foot glacier would mean that its working tools would be short lived, they would become crushed as well as worn away in the abrasion of the rocky crust.

The result of such abrasion is manifested in the great amount of fine silt with which the waters of a melting glacier are filled. This silt, or as it is called, glacial flour, is due to the wear of rocks rubbing on one another.

Recalling the salient feature of the continental ice cap, the following points are important to the understanding of the origin of glacial sands and gravels.

1. Its great thickness permitted it to move majestically over hills and valleys, ignoring the topographical obstacles. However, the under portions naturally were influenced by the ancient land surfaces.
2. It gathered into its mass all the loose litter of the ancient soil blanket, plucking and incorporating great rock masses that were loosely attached to rock ledges.
3. It used much of this material to scour the country rock over which it passed. In using this material, it ground much of it into powder, producing glacial flour.
4. It transported material, often for many hundreds of miles. The amount transported is so enormous that it is incalculable.
5. In southern Canada and the United States the movement of the ice sheet was southerly, with a few local exceptions.

Having the story of the gathering of fragments of earth's waste and its transportation by the ice sheet, we are prepared to consider the distribution that was made of this material upon the melting of the continental glacier.

### After the Ice Melted

Over all the lands occupied by the ice there now lies a mantle of unconsolidated materials that have been deposited from the melting of the ice sheet. This mantle is known as the *drift*. It was deposited in two ways. The greater part of the drift consists of material that was dropped directly by the ice in its melting and was not worked over by water. This

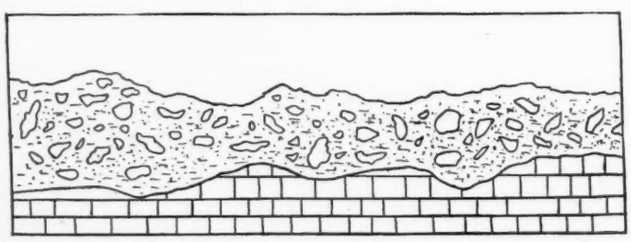


Fig. 2. Section through till, showing its unassorted character, and underlying bed-rock.

unsorted drift is known as *till*. (Fig. 2.) A considerable portion of this till was worked on by running water from the melting glacier and rearranged and deposited in beds or strata. This reworked till is known as the "stratified drift" and is the source of many glacial sand and gravel deposits.

Although deposits of sand and gravel seldom occur in the till, it is necessary in the continuity of our glacial story to describe it. The till is a mass

of heterogeneous material consisting of a matrix of fine clay-like material in which are embedded stones of various sizes, shapes and kinds. The clay matrix is not like the ordinary residuum of clay, which has resulted from the decay of rocks through weathering, but is mostly composed of the fine rock flour, a product of glacial abrasion. The embedded fragments range from the size of coarse sand to great boulders many feet through. There is no arrangement of the rock particles according to size or specific gravity.

Aside from this characteristic of heterogeneity there is another criterion that marks this ice deposit. A very large percent of the pebbles of the till are angular and sub-angular, differing from the rounded pebbles and cobbles of river and shore that have been subjected to wear by water. Again, many of the larger stones in the till still retain the scratches which they received while utilized as tools in the erosive work of the glacier.

It forms an undulating blanket of varying thickness on the hills and hill slopes of a region where it was dumped by the ice and, on account of its elevation above the streams that flowed in the valleys, could not be reworked.

Besides the blanket form, till sometimes occurs massed in oval or elliptical hills with the longer axis approximately parallel to the direction of the ice movement. These till hills are known as *drumlins* and, in certain regions of Wisconsin, New York, and the New England States are striking features of the landscape, their graceful curves forming beautiful crest lines.

### Deposits of Aqueoglacial Waters

The victory of the warm climate over the ice was not won by any sudden rout. There were times when the heat slackened and the ice regained some of the ground it had lost. There were other times when the battle was a stalemate and the ice remained almost stationary. When the forces of sunshine and warm winds were victorious, great rivers of ice water, or as they are called technically, the aqueoglacial waters, poured from the ice front, issued from the ice cap's interior or coursed along the top of the glacier, bearing in their currents tremendous quantities of sand, gravel, cobbles and fine clay. These streams were often so heavily laden that they were unable to carry their load far and piled it in a hummocky debris in front of the retreating ice.

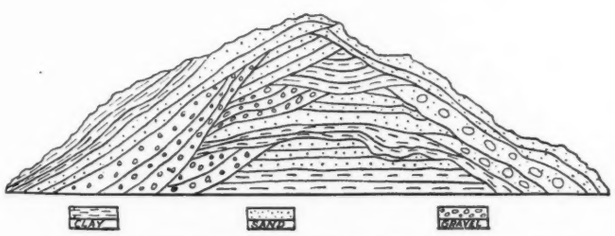



Fig. 3. Section through a kame, illustrating confused stratification.

This water-strewn detritus assumed many shapes, each one caused by some peculiarity of the ice front, by channels in the ice itself, or because of the varying volumes and velocities of the glacial rivers. To each of these forms certain names are given which help us classify the origins of the different forms. Inasmuch as water was at work in all these deposits, we find that they are all more or less stratified and that there is an assortment of the fragments according to size.

As it is from these deposits that our glacial sands and gravels are obtained, we must deal with them in some detail, discussing their origins, their internal structures, and learn to recognize them from their profiles and shapes as they appear now, for, as we shall see, their origin often determines their value as commercial deposits.

The names given to these water-sorted and stratified deposits of the glacial drift may be tabulated as terminal moraines, kames, eskers, lateral stream terraces or glacial terraces, glacial deltas or sand plains, and frontal or outwash plains.

*Terminal Moraines.* Strictly speaking, a terminal moraine is a "hummocky" accumulation of glacial drift which marks the maximum advance of an ice sheet. It is composed of a series of ridges and low hills that roughly parallel the ice front. These elevations are accompanied by corresponding depressions in the form of troughs, and saucer- and bowl-shaped hollows which are often filled with water, forming ponds, lakes and marshes.

In a general way the structure and material of the moraine may be divided into two types. The lower portion consists of a bewildering mixture of till, patches of stratified sand, gravel and clay, and accumulations of large and small boulders. In places the till has been pushed into gentle ridges through the thrusting power of the ice and is comparable to the true till of the ground moraine. In other areas local and limited beds of stratified material occur as lenses in the heterogeneous till.

The frequent presence of boulders is due to their having been carried in the upper portion of the ice, for those that had found their way to the bottom of the ice were crushed and worn away as tools of erosion. Hence, as the ice melted, the uneroded rocks were dropped and concentrated at the ice margin.

The upper portions of a terminal moraine, especially when it was built across valleys or along low lands, frequently consist of stratified material. The stratification is often discordant and the strata are often sharply inclined or even curved. The dip of the strata on the outer edge of the moraine is away from the ice sheet. These beds represent the sorting that the waters from the melting ice accomplished and their material was partly derived from the washed till in the ground moraine and partly from the material brought forward by the waters from the ice.

Since the edge of the ice sheet oscillated back and forth in narrow limits due to minor changes in temperature and as the edge of the ice contained different amounts of debris at different times, the deposits of the terminal moraine show much con-

fusion in their internal structure. The complexity of structure, the mixture of till and stratified material and the frequent occurrence of beds of clay with the sand and gravel as well as belts of embedded boulders make it difficult to estimate the internal character of deposits before they are opened.

Although there are a number of companies operating successfully along the far-flung border of the terminal moraine, the complicated structure of the deposits of such types is such that much preliminary work should be done in investigating an area to avoid running into pockets of till, boulders, or beds of clay.

*Recessional Moraines.* When the ice began to retreat from its line of maximum advance, it frequently paused and remained in a more or less constant position for a considerable period. While in this comparatively static stage there were developed, along its border, accumulations that are very like those of a true terminal moraine. Conditions were similar; the ice front, influenced by temporary changes of climate, oscillated forward and backward within certain limits and deposited the forms and structures characteristic of the terminal moraine.

These recessional moraines are, in their larger aspects, crescentic and appear on a small scale map as festoons concentric to the long lobes of the Continental Ice Sheet.

*Kames.* Mingled with the knobby hills of the terminal and recessional moraines, are similar roughly conical-shaped elevations which contain assorted deposits of clay, sand, gravel, and even large boulders. These mounds are called *kames* and exhibit great variation in outline, size and structure. They may rise as modest mounds a score of feet above the general surface or may extend to heights of a hundred feet or more. Some have slopes of from 25 to 35 degrees, others are more gently sloping. Often they are massed together and mingled in confusion, with ridges connecting some and deep hollows separating others.

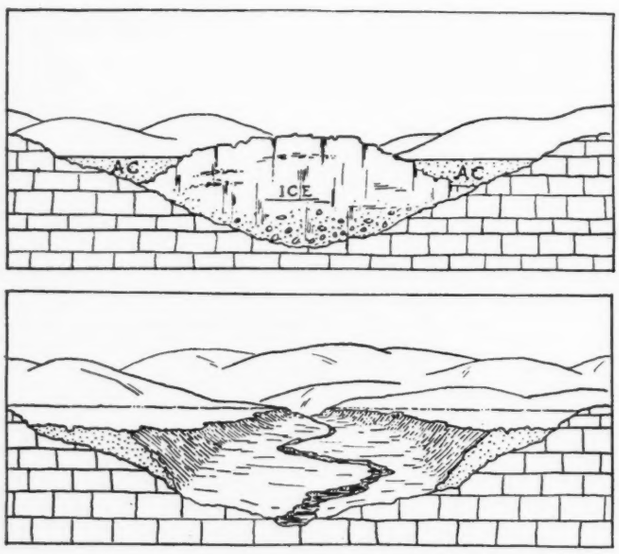
Superficially there exists a close resemblance between the rounded hills of kames and the hills of the terminal moraine; indeed, they are often found together. The difference is in the internal structure instead of the external form. Generally speaking, the material of the kames is more completely stratified and the fragments more water-worn than the stratified deposits of the true terminal moraine.

To understand the origin of kames it is necessary to have a mental picture of the conditions at the edge of the ice during the time of their formation. The front of the ice presented a ragged line with many reentrant angles of various sizes and shapes. From this serrated ice border poured the glacial waters laden with released debris. These waters were not confined to the bottom of the ice, issuing as sub-glacial streams, but also poured over the ice front in cascading streams from the melting of the surface. Furthermore, occasionally tunnels were formed in the ice mass and their waters issued from the ice front at varying heights above the sub-glacial streams. Another condition was also present. The "rotting edge" of the ice front was continually casting off blocks of ice which may have floated a short distance before stranding or, because of heavy protective coating, may have melted less rapidly and maintained their form while other sections of the ice had melted.

This picture of the melting ice front, which has its counterpart in living glaciers of today, particularly the Muir Glacier of Alaska, illustrates how streams form the ice-heaped material in the reentrant angles and between the stranded blocks. When the ice front had melted farther back and the isolated ice blocks had disappeared, the deposited material, some sides of which had been supported by ice walls, slumped and mounds were formed with discordant strata.

Although great kame areas are, in all probability, due to the above described conditions existing at the ice front, isolated kames may have been developed in different ways. Crevasses formed in the ice often served as cavities into which englacial or superglacial streams deposited their loads of detritus. When the supporting ice walls melted, the material which filled the crevasses slumped and formed an irregular ridge.

The origin of kames is reflected in their internal structure, for whatever may have been the genesis of any kame, one or more of its sides was in contact with and supported by ice walls which, upon melting, caused the side to slump, disturbing the




Figs. 4 and 5. The formation of lateral terraces marginal to sides of a valley ice lobe.

original stratification and producing a discordant structure of horizontal, oblique, arching, and even vertical strata. (Fig. 3.) The character of the material in kames is often of considerable variation; beds of gravel may occur between clay strata, and deposits of large cobbles may be found adjacent to layers of fine sand. Occasionally large individual boulders occur. These abrupt transitions between differently graded strata are due to seasonal and even daily changes in temperature which checked or increased the melting of the ice. At

times only fine silt was carried by feeble streams which, at other times, were swollen by excessive melting and became capable of carrying very coarse gravel. The large boulders present were merely released and tumbled onto the accumulations forming at the ragged ice border.

The shape of the larger fragments in kames tends toward angularity as the material has been carried only short distances by the glacial waters. This lack of water-wear is sometimes shown by the presence of glacial scratches on the cobbles.

The content of any particular kame cannot be predicted with any certainty, although, by measuring the angle of the slopes, one may obtain a hint, at least, of the material that lies under it. When unconsolidated material has been banked against a support and that support removed, the slumped sediments will assume an angle characteristic of their texture. This angle is known as the *angle of repose.* Coarse gravel presents an angle of from 30 degrees to 35 degrees and when the gravel is angular it may reach above 35 degrees. The angle of repose for dry sand is from 23 degrees to 28 degrees, while mixed sand and gravel show angles from 28 degrees to 31 degrees.

Although many kames are utilized as resources of sand and gravel, as a class they are very unreliable deposits. Very frequently a kame, when opened, exposes a face of excellently graded sand or gravel, but upon further exploitation the character may change abruptly and its apparent value be destroyed. A large plant should never be established in a kame area unless a thorough preliminary investigation by borings be made and a detailed geological knowledge of its origin be established.

*Eskers.* In certain areas of the glaciated region in the United States, especially in New England, occur winding ridges of sand and gravel ranging in height from 10 feet to over 100 feet, having a width at the base from 30 to 100 feet or more, and a length from 500 feet to several miles. Their crest lines are frequently uneven and narrow. These serpentine ridges are called *eskers* and, like kames, are composed of poorly stratified materials which range from fine particles to cobbles which are subangular, showing short transportation in the glacial waters.

Because of their comparative rarity as well as the limited quantities of material that can be extracted from them by a stationary plant, eskers are seldom the commercial sources of sands and gravels. But on account of their striking topographical features and because some can be used for small plants, a short description of their origin is not out of place.

Eskers are thought to have been formed by the deposition of glacial streams flowing in ice-bound canyons or tunnels in the ice. Such streams aggraded their channels, thus imprisoning a stream bed within the ice itself. Some of these built-up channels rested upon the ground while others must have flowed over an ice bed many feet above the base of the ice.

*Glacial Terraces.* Lying along the margins of many valleys in glaciated regions, especially those that have a north-south trend, are embankments of stratified sand and gravel with clay bands. The tops of these marginal terraces may have a level or "hummocky" surface. Their sides facing the valley sometimes present an even face, but more often exhibit a lobate front. The stratification tends toward the horizontal in the interior but at the edge is oblique and at times discordant.

The origin of these terraces is illustrated in Figs. 4 and 5. During the retreat of the ice, it first vacated the hills, leaving the tongues of ice extending down the valleys. The glacial waters, derived from the sides and top of the melting tongue and augmented by the streams from the main body of the ice at the root of the tongue, as well as by rain wash and the retarded melting of ice remnants of the hills, formed channels between the ice margins and the hillsides. Into these channels the waters washed the material from the sides and top of the ice tongues, as well as some of the till, or ground moraine, which the ice that mantled the hill dumped in its melting. These lateral streams became choked with a bigger load than the stream could carry and the side channels were aggraded with fairly well-stratified material.

Meanwhile, the sides of the ice tongue shrank and, in so doing, developed a ragged edge of small reentrant angles with occasional crevasses extending into the ice. The angles and crevasses were also filled with debris so that when the tongue of ice, which had served as the valley-ward support, had melted, the material, laid down in the channels and washed into the angles and crevasses, slumped toward the valley, producing even or lobate sides depending upon the condition of the ice support at any given point. The ridges, which at times reach out into valleys, represent the material which filled the marginal crevasses.

The tops of glacial terraces are often pitted with depressions, or "kettle holes." These pits are circular, oval, and elongated in shape and were caused by blocks of ice breaking off from the side of the ice tongue or washed down from the larger mass of ice above as bergs. Rapid filling of the channels buried or surrounded these isolated blocks. When they subsequently melted, a depression was left.

Small kames, at times, formed in the notched edge of the ice tongue and frequently a kame area was developed on the sides of the ice lobe where it joined the main body of the ice. Thus the term *kame terrace* is often applied to these lateral deposits along the margin of a valley lobe.

The stratified texture of the true glacial or kame terrace depends upon several conditions which were present during its formation. If the valley was one of a fairly steep gradient, the lateral streams would have had a rapid flow and the deposits would be of a coarse nature especially in the upper section, the clay and silt having been carried farther down stream. But, as in the formation of kames, the amount of water was dependent upon the conditions of climate that prevailed at different times. Swollen streams, due to intense melting, would have strewn

coarse material along these side channels, while cold periods would have enfeebled the same streams and fine sands and clay would have been deposited.

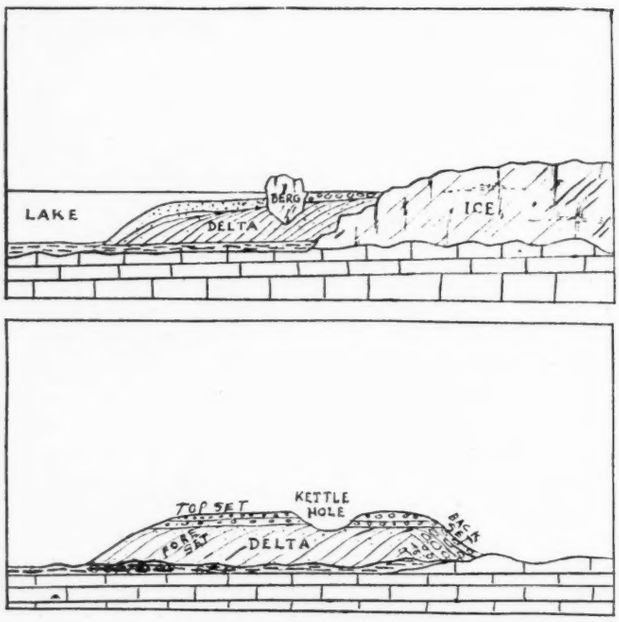
Glacial terraces are much more reliable deposits for sand and gravel products than kames. The stratification is more regular and the beds more consistent in their extensions. The chief element of uncertainty lies in the number and extent of the clay bands and strata of coarse gravels that may be encountered. However, excavations made along the valley face of a terrace would show sections that would serve as indications of the character of the entire formation. This is particularly so if the slope is unbroken by kame-like knobs or ridges, but even these are not so complicated and varied in their constituency as true kames, for they were in reality formed in parts of the channel that may be compared with the marginal pools of a river. The main difference between these ice margin deposits and those of the main lateral channel is that they are apt to contain finer material just as the quiet waters that often border a stream collect the fine sand and mud of the flowing waters.

*Glacial Deltas or Sand Plains.* During the melting of the ice many temporary lakes were formed at or near the margin of the ice. Many causes contributed to the development of such glacial lakes, but it is unnecessary to discuss all the possible origins. It will be sufficient to give a single type of origin, for it is not the lakes that are of interest but rather the deposits that were laid down in them.

Ice, melting in valleys that drained northward in pre-glacial time, would have first freed the southern extensions of these basins, which being at a higher elevation than the floor of the valley over which the ice was retreating, would have impounded the glacial waters until the old northern outlets were freed, thus forming temporary lakes into which the debris-laden waters from the ice would build true deltas. When the northern outlets were opened, the lakes were drained and the deltas remained as topographical features. In general their structure is that of a marine or permanent lake delta but exhibits certain differences. In glacial deltas another type of bed is added to the top-set, fore-set, and bottom-set strata. This new type occurs at the head of the delta and consists of sharply inclined strata. These beds are called the back-set beds and owe their origin to the conditions at the delta's head. This portion of the delta may have been banked against the ice front, which being withdrawn, caused the beds to slip downward; or the stream which built the delta may have issued from the ice under a strong "head" which forced the water upgrade at that point during the building of the delta. These back-set beds contain the coarsest deposits of the delta, for it was at this point where the waters first slackened and deposited their heaviest load.

Another feature which often characterizes these glacial deltas is the presence of "kettle holes" which in some deltas are large and filled with water, forming small lakes. The origin of such depressions has been described in the paragraphs devoted to lateral terraces. Their larger size may be accounted for by the fact that the streams which built the delta had more volume and were able to float larger icebergs away from the ice front. Figs. 6 and 7 diagrammatically illustrate these characteristics of a glacial delta.

Some deltas are longitudinally bisected by streams now flowing in the reverse direction to the delta's formation. This phenomenon was produced by the freeing of the lower or northern portion of the valley by the melting of the ice. The waters of the lake, standing slightly above the top of the delta, tended to flow in the opposite direction when the supporting ice at the head of the delta had




**Figs. 6 and 7. Diagrams showing the formation of a glacial delta or sand-plain.**

retreated to the point where the waters could escape through their normal outlets. The delta, being composed of newly deposited material, offered little resistance to the erosion of these waters and in a very short time a channel was cut which drained the lake toward the north.

A glacial delta is the most reliable and consistent in its regularity of all deposits laid down by the action of the aqueoglacial waters. It has a definite structure which varies only in minor details and was usually formed by a stream capable of carrying not only a tremendous load and depositing it quickly in the quiet waters of the lake in beds characteristic of deltas, but its volume and velocity was usually such that the fine material was washed out and carried into the lake where it settled, forming beds of lacustrine clay. This separation of the clay and silt was furthered through the fact that the lake waters kept this fine material afloat for a time and prevented it from settling with the coarser fragments which would have occurred if the stream had spread itself over the valley as a stream overflows its flooded plain.

It should not be inferred that beds of clay do not

occur in such deltas, for the same enfeebling and augmenting of streams existed here as elsewhere. Climatic changes, slow or abrupt, influenced the texture of the deposits, but because the delta was formed by the master stream issuing from the ice front, whose fluctuations were not so pronounced as those of minor streams, it presents a more regular continuity in its different sections than any other deposit laid down by the waters of the waning glacier.

Another aspect of a glacial delta which often proves attractive to producers is the great variety of sizes it contains. And as these sizes are found in certain structures of the delta one can, with reasonable certainty, locate the sections where the desired product lies.

Referring again to Fig. 7, it is seen that, in general, the texture of the deposit follows certain structures. The very coarsest material is found in the back-set beds; the coarser in the top-set beds, the sand in the fore-set beds. Of course, these general laws have their exceptions. Sand and even clay bands are found in the top-set beds and gravel may occur in the fore-set beds, but such exceptions form but a small proportion of each specialized structure.

*Outwash Plains.* When the area in front of the ice contained no lakes, the waters discharged over a broad plain or through a valley as the pre-glacial topography determined. If the latter was the condition of the terrain in front of the ice, the load of detritus was built into the valley and *valley trains* resulted. On the other hand, if the waters debouched over a broad plain, the material carried was spread as an apron over the plain. Such wide deposits are known as *outwash plains.*

But these types have much in common. Each is built up of material released from the ice and stratified by the issuing streams. The difference is due to the character of the frontal region. Those developed in valleys were built up more rapidly, for the aqueoglacial waters were confined to a restricted area which resulted in greater concentrated volume, permitting them to carry larger particles and heavier loads of debris. Such valleys were often filled to a great depth with stream-swept drift. Many of these valley trains have been subjected to subsequent erosion by post-glacial streams and have been partly cleaned out, leaving remnants standing above the present streams as terraces.

Outwash plains covering a much wider territory are the result of several streams running from an extended ice front. Such streams undirected by confining valleys wandered over a broad expanse, coalescing at some points and forming distributaries at others, thus depositing a broad expanse of assorted material stretching away from the retreating ice. It is apparent that such distribution of the streams weakened their ability to carry an already overladen burden and that a much greater amount of silt and clay was mingled with the sand and gravel than was the case with the deposits of the valley train type.

From longitudinal sections four differences appear, which are usually present in these similar types. The slope of the valley train is greater, has a longer extension, a greater thickness, and a more regular sequence from coarse to fine material away from the morainic front. Cross sections of these same types would show a greater continuity in the beds of the valley train than in those of the outwash plain. This is due to the fact that the outwash plain was built up by many streams, some small and weak, others flooded and strong. As such streams often roughly paralleled one another for a time, then joined, and in a short distance these united streams might have been broken up into distributaries, it is evident that much confusion and sudden shifting of the texture of the strata will be found.

From the descriptions of these deposits made in front and extending beyond the ice, it is apparent that theoretically, at least, the valley trains contain cleaner and more dependable sand and gravel deposits than the outwash plains. However, as is the case in nearly all of the deposits formed by the glacial waters, local conditions and frequent exceptions to the laws that governed and established these various types have, in many localities, produced an unexpected source of high-grade commercial deposits in violation of general statements.

### Material in Glacial Deposits

The preceding descriptions of the forms and structures built by the waters of the ice show that all degrees of texture may be found in their stratified beds. The material contained in these various textures was in part derived from the soil mantles of the old pre-glacial lands or plucked, plowed or ground from the rock crust beneath. Hence a continental glacier would, theoretically, at least, at any given point in its advance, carry representatives of all the soils and rocks over which it had moved. While a similar statement might be made of a river there are a number of important differences which are reflected in the deposits of each type.

The collecting field of a river is confined to the area drained by the master stream and its tributaries, hence all the material transported and deposited is derived from its basin. The continental ice sheet, on the other hand, carried fragments from a number of river basins and drainage systems through and over which it passed. The load carried by a river is limited by its volume and velocity, but the ability of an ice sheet to transport material is almost unlimited. A flowing stream sorts its fragments as it flows, leaving the larger ones nearer their source; in the ice, blocks weighing thousands of tons were carried side by side with sand grains, often for equal distances. The resultant ice deposits are aggregates of various kinds of material ranging in size from finely divided substances to large boulders.

The fragmental particles of glacial deposits were, when released by the ice, fresh and angular, for they originated through rock fracturing, abrasion and crushing, rather than decomposition. Even the sands of very fine material which resemble clay are often composed of finely comminuted quartz, the result of rock scrubbing. These ice-borne fragments

lost some of their angularity when deposited by the streams of the melting ice, their edges having been blunted and subdued into sub-angular forms by the limited, but often tumultuous aqueoglacial waters.

### Commercial Fitness of Aqueoglacial Deposits

From a practical point of view it is not necessarily the type of deposits nor the shapes of their fragments that make them of commercial value.

It is rather their cleanliness, or absence of clay, loam, organic matter and other deleterious substances, and the durability of their particles. Both of these qualities are dependent on the character of the country rock over which the glacier passed.

In the United States all the material spread over the country in the various forms of glacial deposits originated northward of its place of deposition. Although the distance over which material may be transported by ice may be equal to the distance the ice has traveled, by far the largest proportion of the fragments in any glacial deposit consists of particles whose source was from a few feet to a few score of miles to the north of the deposit. While it is true that there are found many fragments that have been transported hundreds of miles, they form a small percentage and owe their presence to their extreme hardness and their ability to survive the long journey.

To estimate the lithology, or mineral composition, of glacial deposits, a knowledge of the rock structures lying to the north of such accumulations is necessary. The diagram, Fig. 8, illustrates the derivations of material from various rock structures.

A, B, C, D and E represent rock strata that appear at the surface over which the ice moved. A indicates shale; B, sandstone; C, limestone; D, sandstone, and E, shale. I, II, III, IV and V represent various types of moraines built during haltings of the ice; although the diagram does not indicate their type they may be kames, eskers, terraces, deltas or valley trains and outwash plains. No. I was the first one to be deposited and hence is composed of fragments plucked from E, D, C, B, with a certain percentage from A. No. II was formed after A, and contains material from E, D, C, with some from B. Subsequent retreats of the ice established III, IV and V, which were governed by the same conditions as I and II.

Moraine deposit No. I will, therefore, contain a considerable amount of shale derived from A, with a large amount of sand from the sandstone B that lay just north of it, and a percentage of limestone from the strata C with varying small amounts of sand from D and shale from E. Deposit No. II would have less clay and shale particles in it than No. I, for the nearest source of shale was at the point where the E strata outcropped many miles to the north. On the other hand, the morainic deposits at No. V would be filled with shale particles from the E beds, which formed the surface rocks directly north. Incidentally, all the moraines would contain fragments of hard rocks as granites and gneisses, if such types outcropped farther north. The diagram and explanation prove the necessity of geological knowledge in estimating the character of the rock fragments in glacial deposits.

There are other practical results obtained through a knowledge of the rocks which form the source of the glacial deposits. Ice, unlike water, transports material without much accompanying decomposition with the result that particles of rocks, such as finely laminated shales, travel in the ice and become buried in the glacial deposits without splitting into thin leaves. When a fresh face is opened in the deposit, such pieces, especially when they have the size of gravels appear to be solid, but upon exposure to the atmosphere over a period of time, break up into flakes. The same is true of sand derived from these thin shales, but it is not so readily observed. Where such material has been deeply buried, it may retain its shape for weeks after being mined. Thus it is well to know the weakness of such gravel and study it at the place where its parent rock has outcropped for years exposed to the weather.

A characteristic feature of many gravels, especially of southern New York, is the presence of flattened ovate discs of sandstone. Applying the law that accounts for their place of origin, it is found that they are derived from the Devonian shales and sandstones that form the surface rock of a large portion of the south central part of the State. In many places these sandstones are thin bedded and when overridden by the ice were detached in slabs. Subsequent sorting by water tended to further split these slabs along their lines of weakness, with the result that they were broken into flat pieces whose angular corners and edges became rounded through water action.

Glacial deposits that have been derived from the ice passing over a limestone region are apt to develop into a glacial conglomerate. This is due to underground and surface water dissolving thin films of lime from the gravel in these deposits. When this solution is exposed to the air or released from underground pressure, it precipitates the lime in solution around the loose aggregate of the deposit, binding fragments together with a firm and durable cement of calcium carbonate. This destroys the value of the sand and gravel for concrete purposes and its presence in a deposit causes difficulty in the workings of the face, as the conglomerate is often compact and indurated as a rock. Here again too much limestone at the surface north of the glacial deposit gives warning of possible conglomerates.

In many glacial accumulations there are found gravel particles that are coated with a brown dust resembling iron rust. Concrete engineers object seriously to the presence of these "brown stones" in gravel deposits. They are often called "rotten stones" because when some are crushed, they crumble to powder. On the other hand, the brown coating may be very superficial, not affecting the durability of the stone or impairing its usefulness. How, then, may the producer determine whether

*(Continued on page 47)*

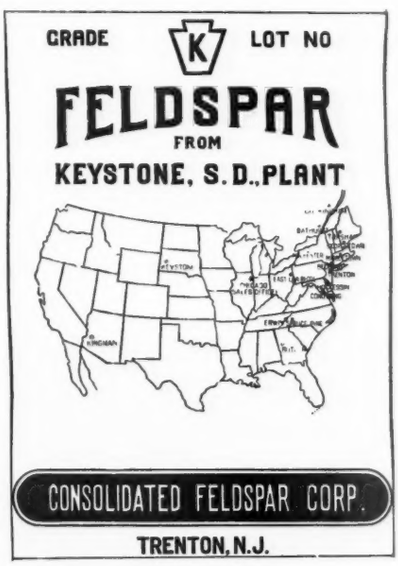
# Black Hills Feldspar Mining Industry Has Interesting History

## Other Useful Commercial Minerals Are Recovered With the Principal Product

By FRANCIS CHURCH LINCOLN
Professor of Mining, South Dakota State School of Mines

THE Consolidated Feldspar Corp. is now operating in the Black Hills of South Dakota, where it has a lease on the Hugo feldspar mine near the town of Keystone and owns a feldspar grinding plant in Keystone. The Consolidated Feldspar Corp., as its name implies, is a consolidation of a number of feldspar mining and grinding interests. It is closely allied with other feldspar companies which are controlled by its president, Herbert P. Margerum.

The Keystone plant formerly belonged to the feldspar department of the Isco-Bautz Company of Murphysboro, Ill.; and its relation to the various consolidated and allied interests under the control of Mr. Margerum may be most readily understood from a brief history of these organizations, the data for which has been kindly supplied by V. V. Kelsey, sales manager of the enterprise.




Front of shipping sack.

In the early days of the pottery industry in the United States, the pottery manufacturing concerns produced their own raw materials, such as flint, Cornwall stone, and feldspar and ground them in their own plants. In 1865, Moses Golding, of Trenton, N. J., then in the foundry and machine business, conceived the idea of preparing ceramic raw materials in specially designed plants and selling them directly to the pottery manufacturers. With this in mind, he built a feldspar and flint grinding mill in Trenton, and this mill is believed to have been the first established in this country. This marked the beginning of the Golding Sons Co. which, for the past sixty-five years, has been rendering a service to the ceramic industries by furnishing them with products of uniform quality.

Starting with the one small plant at Trenton, Golding Sons Co. expanded until it now owns feldspar mines in Maine and North Carolina; feldspar grinding mills at Trenton, N. J.; East Liverpool, O.; Erwin, Tenn.; and Spruce Pine, N. C.; together with clay plants at Hockessen, Del., and Butler, Ga.

The controlling interest in the Golding Sons Co. was purchased by Herbert P. Margerum in 1924. In 1925, he purchased also the controlling interest in the Erwin Feldspar Co. with

Grinding mill, office on right.

Main open cut.

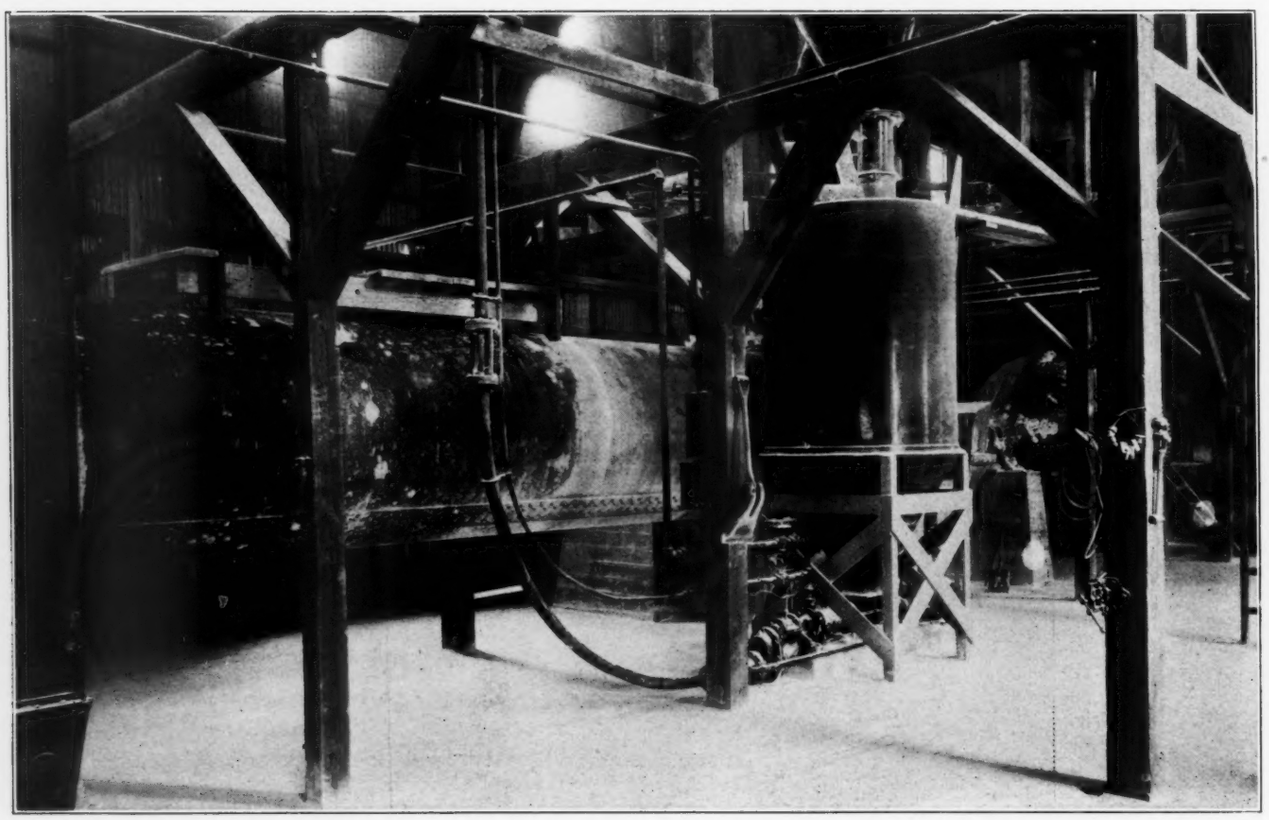
mills at Erwin, Tenn., and Spruce Pine, N. C.; and, in 1926, the North Carolina mines and the Erwin, Tenn., mill of the Clinchfield Products Corp. of New York, were acquired and made a part of the Erwin Feldspar Co. The Erwin company is the largest miner and grinder of North Carolina feldspar. In 1929, the Consolidated Feldspar Corp. was organized, with Mr. Margerum as president, to consolidate the following:

Maine Feldspar Co., Brunswick, Me.; Bedford Mining Co., Bedford, N. Y.; Dominion Feldspar Corp., Rochester, N. Y.; New York Feldspar Corp., Rochester N. Y.; and Feldspar Department of Isco-Bautz Co., Murphysboro, Ill.

General view of Hugo mine.

It is planned to make the Golding Sons Co. and the Erwin Feldspar Co. integral parts of the Consolidated Feldspar Corp. at an early date. The Consolidated Feldspar Corp. acquired extensive feldspar deposits near Kingman, Ariz., in 1929, which will be developed later. It is thus evident that, when the plans of the organization have been completed, the Consolidated Feldspar Corp. will be in a position to supply any commercial grade of feldspar from Maine to Arizona and from Canada to North Carolina.

The occurrence of large masses of feldspar in the pegmatite dikes of the Black Hills has been known



Interior of grinding plant showing tube-mill, air separator pumps and conical mill.

Grinding plant with superintendent's house on left.

for many years. The first man to take an active interest in the commercial possibilities of Black Hills feldspar was Dr. A. T. Roos of Rapid City, S. D. He sent samples to Golding Sons Co. and to the University of Ohio in 1919 and 1920; and, when the analytical and fusion tests made upon these samples proved the high grade of the feldspar, he started an agitation for favorable freight rates on feldspar from the Black Hills to midwestern grinding plants. Reduced freight rates were put into effect in 1923, capital was interested, and the Keystone Feldspar and Chemical Co. was organized. For five years this company was the only shipper of feldspar from South Dakota; and from 1923 to 1929, inclusive, it shipped 16,329 tons of feldspar. During the first year, most of the feldspar shipped was obtained by sorting the waste dumps of the Keystone pegmatite mines which had been worked for mica, lithia minerals, and other rare minerals; but, thereafter, it was secured mainly by mining from the Hugo mine. The second company to ship feldspar from the Black Hills was the Abingdon Sanitary Manufacturing Co. of Abingdon, Ill., which, in 1928, began the shipment of feldspar from the White Elephant mine near Pringle to its grinding plant at Abingdon. The Keystone Feldspar and Chemical Co.'s lease on the Hugo mine, was taken over by the Consolidated Feldspar Corp. in 1929; and the new corporation shipped 1,080 tons of crude feldspar from the mine to its own grinding plants during 1929. In December of last year the company produced 400 tons of ground feldspar in its new grinding plant at Keystone.

Hugo mine, with Mt. Rushmore in distance.

### Location and Geology of Hugo Mine

The Hugo mine is located 1¼ miles south of the little mining town of Keystone at an elevation of 4,700 ft. above sea-level. Looking northwestward from the mine, a good view may be obtained of the 60-ft. head of George Washington, the completed feature of the National Memorial which is being carved on Mount Rushmore, four miles away, by the noted sculptor, Gutzon Borglum.

The mineral deposit at the Hugo mine is a pegmatite dike which has been intruded into the pre-Cambrian mica schist of the region and now rises from the surrounding schist like a wall, owing to its greater resistance to erosion. The pegmatite is a coarsely crystalline granite, which contains not only the minerals usually found in granite —quartz, feldspar, and mica —but also (like many other pegmatite bodies in this region) a number of rare minerals as well. The Consolidated Feldspar Corp. is mining and grinding both microline, a potash feldspar, and albite, a soda feldspar, and is mining and shipping some muscovite mica. It has also mined a lit-

Mica mine open cut.

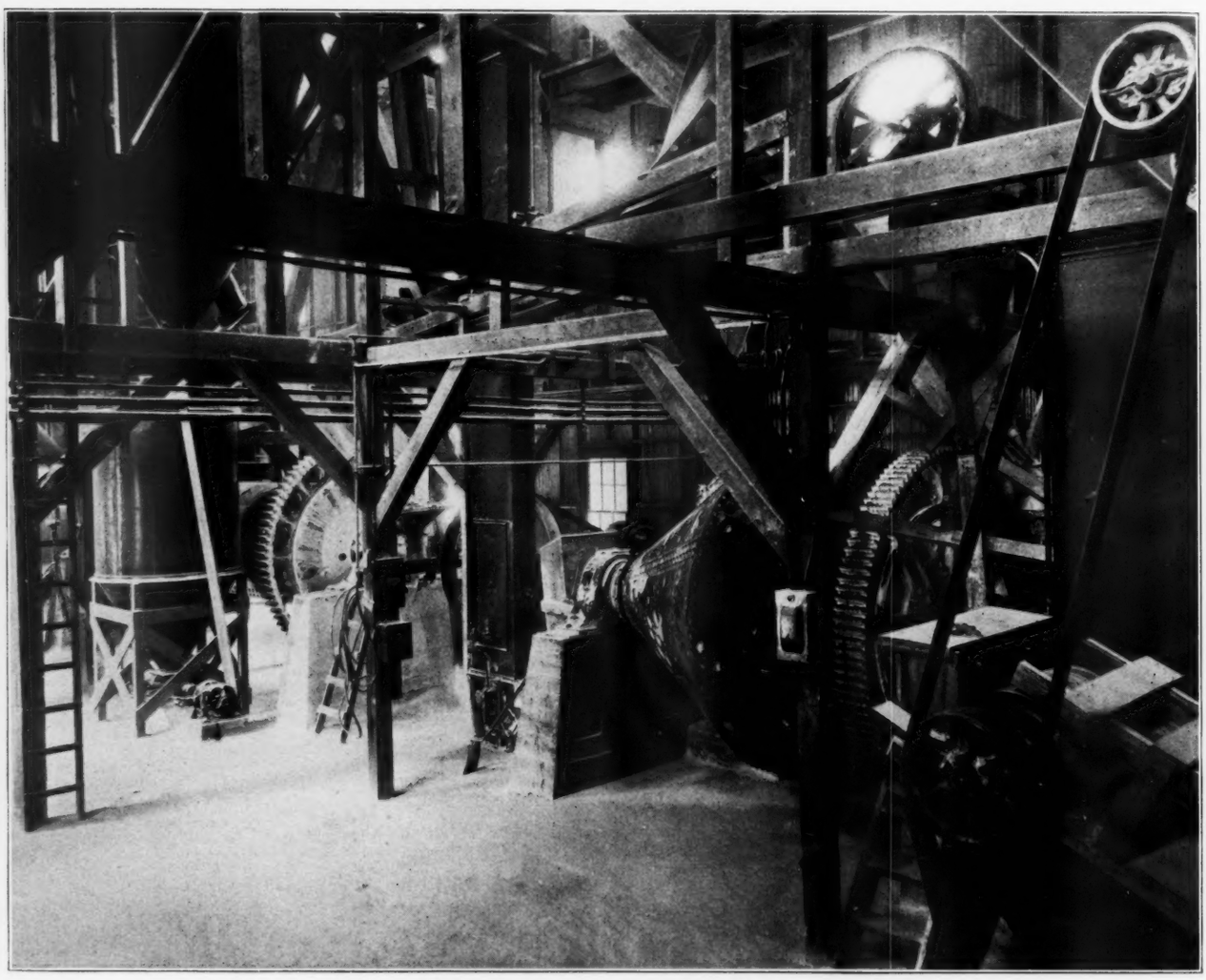
tle beryl and small quantities of the lithium minerals, spodumene and amblygonite; but according to the terms of the lease these minerals do not belong to the corporation and are set aside to be shipped by the owner of the mine. In the past, the Hugo mine has produced a little columbite, an ore of tantalum. Small amounts of cassiterite, tin oxide; lithiophilite and triphylite, lithium minerals; and apatite, a phosphate, have been found.

The Hugo mine is leased from Hugo Reinhold. Mahlon Susong is local superintendent for the Consolidated Feldspar Corp. and has charge of both the mining and the grinding. Herbert J. Atcheson is mine foreman with from four to six miners working under him.

Mining is conducted entirely by the open-cut method. Drilling is performed with a Sullivan sinker drill which puts down vertical holes 10 ft. in depth, 10 ft. back from the face, and 10 ft. apart. The drill sharpening shop is equipped with a home-made forge using compressed air and a Sinclair portable drill sharpener made by the Denver Rock Drill Mfg. Co. The compressed air for drilling is supplied at 100 lb. pressure by a Gardner portable compressor which is driven by a Fordson tractor. The holes are loaded with 7 or 8 sticks of 40 per cent Dupont Special gelatin dynamite; and fired with Black Monarch fuse and No. 6 Dupont caps. Blasting is done about twice a week.

The broken feldspar is cobbed and graded by hand, and is then trammed by hand in four Card Iron Works 1,500-lb. cars to the shipping bin, which is equipped with a chute fitted with a ¾-in. grizzly for removing the fine impurities from the coarse sorted feldspar. The muscovite (mica) mined is also prepared for shipment by the hand-cobbing process; while other valuable minerals encountered in the course of mining the feldspar and mica, are set aside for Mr. Reinhold who ships them from time to time. The waste material, consisting largely of quartz, is hand-trammed to the waste dump. About one-half of the miners' time is employed in mining and one-half in sorting. A 2-ton White truck owned by a local contractor transports the hand-picked feldspar from the shipping bin at the mine to the grinding plant at Keystone.

The Keystone plant grinds about 500 tons of feldspar per month. It is situated beside the railroad just outside the town of Keystone and is served by a short loading spur. The railroad at Keystone is a 10-mile spur of the Chicago, Burlington and Quincy



Grinding mill showing air separator, conical mill, and tube-mill.

line from the little town of Hill City which lies to the westward. The grinding mill commonly operates two shifts a day, two men being required on each shift; but sometimes three shifts are required daily to keep up with orders. Power for the mill at 220 volts is purchased from the Battle Creek Power Co. at Keystone. The electrical wiring and lighting for the plant were designed and supplied by the Mine and Smelter Supply Co.

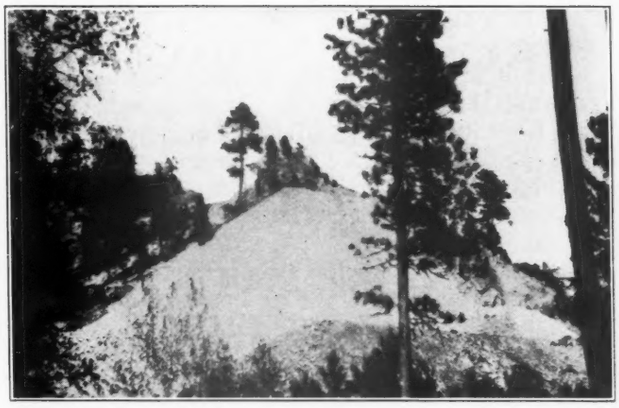
### Coarse Crushing and Storage

The sorted feldspar from the Hugo mine which comes to the grinding plant by motor truck, is first weighed upon Howe truck scales located in front of the plant office building, and then delivered to the coarse crusher. This is a 10-in. by 18-in. Reliance jaw crusher made by the Universal Road Machinery Co. and equipped with corrugated jaw plates set to crush the feldspar into pieces of ½-in. maximum diameter. The crusher is driven by a 7½-hp. Westinghouse electric motor. A 14-in. Delhi rubber belt conveyor moved by the crusher, transports the crushed feldspar to a bucket elevator with 45-ft. centers. This elevator was made by the Weller Manufacturing Co., by mounting 6-in. by 4-in. malleable iron buckets upon an 8-in. belt; and is driven by a 7½-hp. Westinghouse electric motor. The elevator buckets deliver their load to a horizontal Delhi rubber conveying belt which is equipped with a Weller automatic conveyor tripper and obtains its power from the same motor that drives the bucket elevator. The tripper may be set to deliver the load on the horizontal belt conveyor to any one of 10 bins, each of which has a capacity of from 85 to 90 tons. A second bucket elevator, identical in every respect with the first, has been installed beside the elevator just described. This has been done so that a vertical dryer may be readily installed in case the feldspar should ever come from the mine in a state too wet to pulverize; but, up to the present time, the feldspar has given no indication of requiring to be dried.

### Intermediate Crushing and Screening

The ten storage bins are fitted with Mine and Smelter Supply Co. arc bin-gates through which their contents may be drawn into a 7-cu. ft. Card Iron Works batch car. The bins contain different grades of feldspar which may be ground separately

Floor of Hugo mine.



Waste dump.

or mixed in any desired proportion with the aid of the batch car. This car dumps upon a 24-in. inclined conveyor belt whose upper end passes over an 18-in. Dings magnetic pulley which removes any scrap iron which may have found its way into the feldspar. The inclined belt delivers its load to a Weller bucket elevator like the two installed in the storage section but with 34-ft. centers.

The magnetic pulley belt and the bucket elevator are both driven by a 7½-hp. Westinghouse electric motor; while a 3-hp. General Electric motor direct-connected to a 250-dc. generator furnishes the necessary current for the magnet of the Dings pulley. The elevated material drops into a 45-ton bin, from which it is fed by automatic feeder to an 8-ft. by 30-in. Hardinge conical mill. This mill is driven by a 60-hp. Westinghouse electric motor through a Texrope drive. It is lined with Belgian silex and loaded with No. 5 French pebbles—because iron in balls or lining would ruin the feldspar for ceramic uses. The Hardinge mill ordinarily reduces the feldspar from ½-in. to 12-mesh. Its product is raised by a Weller bucket elevator exactly like the two in the storage division to a 3-ft. by 5-ft. Hum-mer vibrating screen, which returns the oversize product and sends the undersize to the air separator.

Occasionally, a 20-mesh or 40-mesh product is required for the glass trade, in which case the Hummer is equipped with the proper screen and the finished product goes direct from the screen to the shipping bin by belt conveyor. A 7½-hp. Westinghouse electric motor supplies power for the Hummer screen, the elevator to this screen, the belt conveyor to the shipping bins, and the elevator from the tube-mill to the air separator.

### Fine Crushing and Air Separation

The air separator is a 14-ft. Sturtevant driven by a 20-hp. Westinghouse electric motor. The coarse product from the air separator goes to a 5½-ft. by 22-ft. Allis-Chalmers tube-mill which is driven by a 75 hp. Westinghouse electric motor through a Texrope drive. This mill employs No. 2 French pebbles for grinding and, like the Hardinge mill, is line with Belgian silex. When the tube-mill requires relining, the entire grinding operation may be performed in the Hardinge conical mill, the coarse product from

the air separator being returned to the Hardinge mill by belt conveyor.

The ordinary size of the finished product is 99½ per cent through 200-mesh. Sometimes there is a call for 140-mesh or 160-mesh material, in which case the grinding may be more uniformly distributed by sending the oversize of the Hum-mer as well as the coarse product of the air separator to the tube-mill.

After the feldspar has been ground in the tube-mill, it is raised by a Weller bucket elevator, with 50-ft. centers, to the air separator which returns the

Compressor house and shipping bin.

coarse product. The fine product from the air separator is caught in a 5-ton steel storage tank from which it is pumped by means of a 4-in. Fuller-Kinyon pump to any one of six 75-ton shipping bins on the end of the grinding building above the spur track. The Fuller-Kinyon pump is driven by a 10-hp. General Electric motor; and the compressed air for it is furnished by an Ingersoll-Rand 5-in. by 5-in. compressor driven by a 15-hp. Westinghouse electric motor. There is a 1½-ft. by 6-ft. air receiver in the compressed-air line which was made to order.

The bulk of the feldspar shipments from Keystone are of material 99½ per cent of which will pass a 200-mesh sieve. Small amounts of 160-mesh, 140-mesh, 40-mesh, and 20-mesh feldspar also are shipped. Both potash and soda feldspars and mixtures of the two are prepared. In the neighborhood of one-half of the material is shipped in bulk, the other one-half being shipped in 100-lb. paper valve-sacks. A one-tube Bates packer is installed beneath the shipping bins for filling these sacks. In carload lots, f.o.b. Keystone, the ground feldspar brings $11 per ton for 20-mesh material, $12 per ton for 40-mesh, $13 for 100-mesh, $14 for 140-mesh, and $15 per ton for 200-mesh material. Bags are charged at 6 cents each, which means an addition of $1.20 per ton to the above prices for sacked feldspar. Shipments of Black Hills feldspar are made to Ohio, Illinois, Pennsylvania, Indiana, Tennessee; as far east as Camden, N. J., and as far south as Macon, Ga.

Black Hills feldspar is in great demand on account of its high quality. A recent analysis of the potash feldspar gave the following results:

| | Per Cent |
|---|---|
| Loss on Ignition | 0.36 |
| $SiO_2$ | 64.70 |
| $Al_2O_3$ | 19.50 |
| $Fe_2O_3$ | .07 |
| $TiO_2$ | Trace |
| $P_2O_5$ | .28 |
| CaO | .11 |
| MgO | .12 |
| $K_2O$ | 11.21 |
| $Na_2O$ | 4.19 |
| MnO | None |
| Total | 100.54 |

The soda feldspar has the following analysis:

| | Per Cent |
|---|---|
| Loss on Ignition | 0.75 |
| $SiO_2$ | 65.25 |
| $Al_2O_3$ | 21.79 |
| $Fe_2O_3$ | .088 |
| CaO | 1.03 |
| MgO | .03 |
| $Na_2O$ | 9.93 |
| $K_2O$ | 1.14 |
| Total | 100.008 |

The white potash feldspar from the Hugo mine is of excellent color and fuses at cone 8 plus, or at a temperature of 1,300° C. While not so fusible as Canadian salmon feldspar, its color after fusion is distinctly superior.

## Unusually Well Designed River Plant

(*Continued from page 25*)

screening plant is 45 ft. This line also furnishes water for the Rogers steam locomotive which does all switching and spotting of cars.

A neat wood-frame structure near the plant houses the office, store-room and machine shop, all of which were built with as much attention to detail as was the plant proper. The machine shop contains a Champion hand-operated drill press, a Hall and Brown planer and edger, a J. A. Fay and Egan Co. band saw, a Merrell Mfg. Co. pipe-threader, an emery wheel, a wood-turning lathe, a key-seater, a forge, and all other equipment required to do almost any kind of repair work.

Adjoining the machine shop is the miscellaneous storage room where is kept a complete stock of any equipment or large repair parts that might be necessary. The stock includes such things as cable, rope, chain, blocks and pumps. The next room is a store room for small parts, bolts, and all kinds of tools. Wrenches, saws, drills, shovels and other tools are hung along the wall and the check system is used to insure the return of each tool by the employee to whom it is issued. Repair parts and bolts are stored in racks, each piece of equipment, such as one of the engines, the dredge pump, or the screen, having a separate section for its repair parts.

The office is also completely equipped with a safe, typewriter and other equipment. In addition to the plant office there is a handsomely furnished private office for the president. M. Stodder is plant superintendent.

# Nashville Ready-Mixed Concrete Plant Stores Combined Aggregates

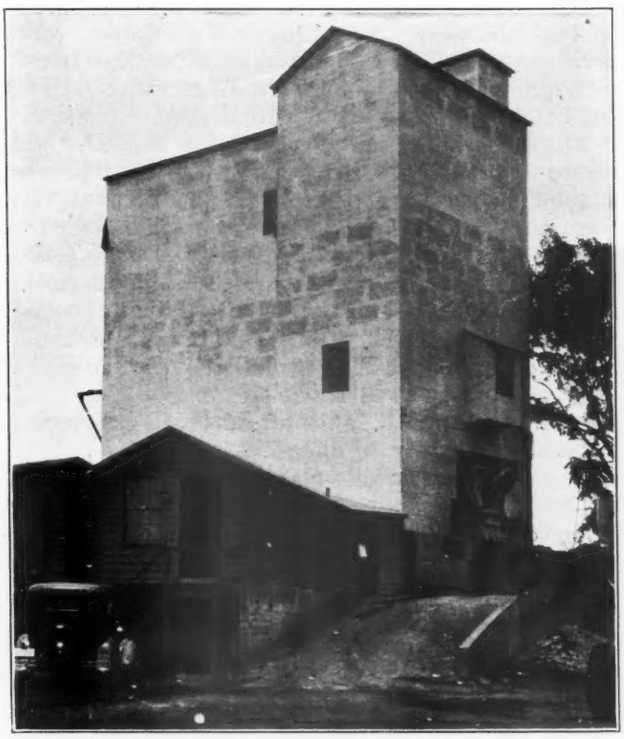
## Plant is Unusually Well Located for Distribution to Entire City

ONE of the most recent additions to the rapidly growing list of concrete central-mixing plants is that of the Nashville Ready-Mixed Concrete & Supply Co., at Nashville, Tenn., which went into operation in May of this year. It has a capacity of 400 cu. yd. per day and, when improvements now under way are completed, it will be one of the few plants in operation having graded material in the bins. Six grades of combined sand and gravel will be stored in the bins above the mixers.

This is the first commercial central-mixing plant in Nashville and has been operating at or near capacity since it first went into operation. Its location at 10 Fatherland St. is just across the Cumberland River from the main business and industrial section of the city. Due to the larger number of bridges crossing the river, traffic congestion in delivering the concrete can be avoided to a great extent by crossing the river at the most convenient point.

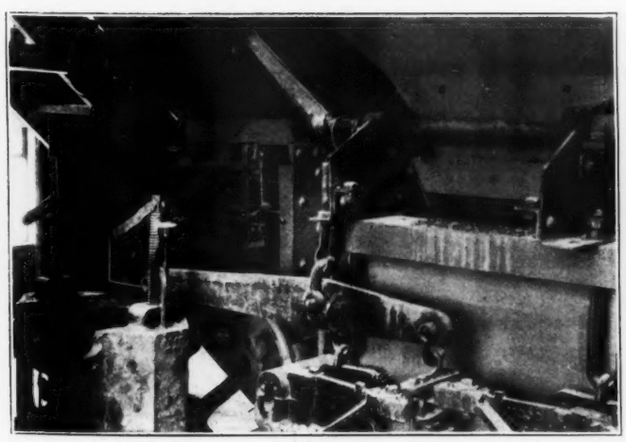
The sand-and-gravel aggregate is, at present, handled by cranes, from the neighboring plant of the Cumberland River Sand Co., to a hopper. This feeds to two bucket elevators, a Webster and a Good Roads, which discharge through a swivel chute into any of six compartments in the 250-ton-capacity Blaw-Knox steel bin above the plant. Four sizes of gravel and two of sand are stored. The use of two elevators insures against delay in case of a breakdown.

Cement is received in bulk and is unloaded from the cars into a ground hopper. This feeds a Webster 56-ft. bucket elevator which discharges into a 3-car-capacity, two-compartment Erie steel bin alongside the aggregate bin. A 37-ft. Webster screw conveyor feeds from the bin to the mixers.



Plant from east, with office in foreground and one of mixers at right.

The plant has two mixers of 1-cu. yd. capacity each. The one commonly used is a T. L. Smith drum-type mixer located on one side of the plant. The gravel for this mixer is weighed in a Blaw-Knox 1-ton-capacity weighing batcher. The sand is measured in a 28-ft. inundator and the cement in a 1,000-lb.-capacity weighing batcher, both of



Weighing batcher used to measure cement and aggregates to one of the mixers.

One of the trucks discharging concrete to a large school construction job.

Blaw-Knox make. The measured materials are then discharged into the mixer hopper, where the batch is held until the mixer is ready for another charge. Additional water for the mix is supplied from a tank alongside the inundator.

The second mixer, which is used when additional capacity is required, is a Koehring 28 S. It is adjacent to the other mixer but faces a truck driveway which runs under the building. Water is measured in a Blaw-Knox water-measuring tank, cement in a 1,000-lb.-capacity weighing batcher, and sand and gravel in a 2-ton-capacity, 2-compartment weighing batcher, both of Blaw-Knox make. All of the batchers are equipped with Fairbanks scales.

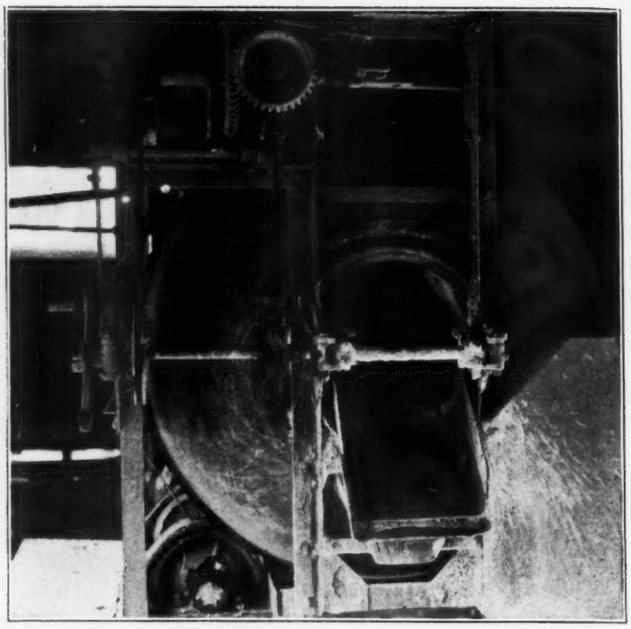
The Koehring mixer is used also to mix lime and cement mortars to order. Lime and cement are supplied in sacks and are elevated by a vertical platform elevator to various floors of the building for storage. When a batch of mortar is to be mixed, the lime or cement required is dumped through a chute into the mixer. In addition to regular sand, special sands or granite dust can be used as specified.

The concrete and mortar are delivered in eight 3-ton pneumatic-tired Mack trucks equipped with Blaw-Knox 2-cu.-yd. agitator bodies. Deliveries are made regularly to distances as great as eight miles. At the time this plant was visited, regular deliveries of concrete were being made to a large new public school about four miles from the plant.

There are no restrictions whatsoever on the use of ready-mixed concrete on any kind of construction work in Nashville. The product has, from the first, met all tests and specifications and its quality and uniformity is guaranteed by the presence, on the job at all times, of an inspector from the Southern Testing Laboratory, who makes all the usual tests.

The installation now being completed consists of a 24-in. Stephens-Adamson belt conveyor which will take materials from the new grading bins under construction by the Cumberland River Sand Co. The six sizes of graded aggregate, as has been previously explained, will be stored in the 6-compartment bin above the mixing plant. When this system is in use experiments will be made in the measurement of the combined graded aggregates by the inundation method. This installation will be completed within 30 days.

The Nashville Ready-Mixed Concrete & Supply Co. is an independent organization. Officers are: A. D. Creighton, president; C. C. Robertson, vice-president; W. E. Haswell, secretary and treasurer; and T. A. Bowers, superintendent.



One of the 1-cu. yd. mixers.

Mixer discharging to one of trucks.

## Serious Sessions of Safety Congress Interspersed With Pleasure

Among the entertainment features planned during the coming National Safety Congress in Pittsburgh, Pa., will be a moonlight steamboat ride up the historic Ohio river, Tuesday evening, Sept. 30, as guests of the local members.

On the evening of the opening day, Monday, Sept. 29, the president's reception and a dance will be held, while on Thursday evening, all of the registered guests will be invited by the exhibitors to the Smile Party which is an annual feature.

## Excellent Materials—Handling

(*Continued from page* 27)

which the molded brick are placed on brick cars standing on turntables, one on either side of each press. This requires sixteen narrow-gauge tracks and turntables to provide means for transfer of the brick, by small hand-propelled cars, from any table to any one of the nine steam drying cylinders. Finished storage sheds run across the plant at the finish end of the cylinders, and the finished bricks are loaded directly on trucks from the brick cars.

# Specifications Covering Hydrated Lime Proposed by Federal Board

THE specifications which are being promulgated by the Federal Specification Board to cover quicklime purchased by the U. S. Government were printed in the August 13 issue of PIT AND QUARRY. The following material is a condensation of Specification No. 249, which deals with hydrated lime for structural purposes.

Hydrated lime is of two types: type M, masons'; and type F, finishing. Either type is a fine white powder produced by the action of water on quicklime. It consists essentially of calcium hydroxide naturally associated with more or less magnesium oxide or hydroxide.

Hydrated lime must contain not less than 95 per cent calcium and magnesium oxides computed on the non-volatile basis. It must not contain more than 5 per cent carbon-dioxide (computed on the non-volatile basis) if the sample be taken at the place of manufacture, nor more than 7 per cent if the sample be taken elsewhere.

It must not leave a residue of more than 0.5 per cent on a No. 30 sieve, nor more than 15 per cent on a No. 200 sieve.

When tested by the method described herein, the specimen of hydrated lime must show neither popping nor disintegration. Type F hydrated lime shall have a plasticity figure of not less than 200.

### Sampling and Inspection

One and one-half per cent of the number of packages (but not less than five packages) shall be sampled. Samples shall be taken by means of a sampling tube not less than one-half inch in diameter, inserted longitudinally in the package and extending its entire length. The material so collected shall be mixed and quartered to 15 lb. This shall be divided into three parts of 5 lb. each, which shall immediately be sealed in air-tight containers. One of these shall be sent to the consignor, one to the consignee, and the third held for retest in case of dispute.

Sampling shall be conducted as expeditiously as possible to avoid undue exposure to the air. Samples shall not be taken from broken packages.

### Chemical Analyses

*Calcium oxide.*—Weigh out 0.5 g. of the material and transfer to a platinum or porcelain evaporating dish, mix to a thin slurry with distilled water, add 5 to 10 ml. of HCl (sp. gr. 1.20), digest with gentle heat, and agitate until solution is complete. Evaporate this to dryness so far as this may be possible on the water bath. Heat the dish and its contents in a drying oven for one hour at 110 to 120 deg. C. Drench the cooled mass with 20 ml. HCl (1:1) and allow to stand for a few minutes. Add an equal volume of water and heat on water bath for 10 min. Filter. Wash thoroughly with dilute HCl and then twice with cold water. Evaporate the filtrate to dryness. Extract with HCl as before, allowing only a few minutes' time. Filter through a second paper. Place both filter papers and their contents in a platinum crucible and ignite to constant weight. Add 5 ml. HF and two drops $H_2SO_4$ to the ignited residue. Evaporate to dryness and ignite for two or three minutes. Fuse the residue with a little $Na_2CO_3$. Dissolve the cooled melt in HCl and add the solution to the filtrate obtained above. Add a few drops of bromine water or nitric acid and boil until all trace of Br or Cl is gone. Then add HCl if necessary to insure the presence of 10 ml. of concentrated acid. Add a few drops of methyl-red solution, dilute to 200 ml. and boil. Neutralize with $NH_4OH$ (dilute toward the end) until the color of the liquid changes to a distinct yellow. Boil for one or two minutes, allow to settle, filter and wash two or three times with a hot 2-per cent solution of $NH_4Cl$. Suck dry. Dissolve the precipitate by letting hot dilute HCl run through the paper into the beaker in which the precipitation was made. Wash thoroughly with hot water. Boil to expel any trace of Cl, and reprecipitate with $NH_4OH$ as described above. Filter, wash two or three times with a hot 2-per cent solution of $NH_4Cl$, and combine this filtrate with the one obtained above. Add a few drops of $NH_4OH$ and boil. Add 35 ml. of a saturated solution of $(NH_4)_2OC_4$ and continue the boiling until the precipitated $CaC_2O_4$ assumes a granular form. Allow to stand 20 minutes or until the supernatant liquid is clear. Filter and wash thoroughly with hot water. Ignite the precipitate in a platinum crucible. Dissolve in hot dilute HCl and make up to 100 ml. with water. Add a slight excess of $NH_4OH$ and boil. If any aluminum hydroxide separates out, filter, wash with 2-per cent $NH_4Cl$ and discard the precipitate. Treat the filtrate with $(NH_4)_2C_2O_4$ and proceed as before. Ignite the precipitate to constant weight in a platinum crucible, and record as calcium oxide.

*Magnesium Oxide.*—Acidify the filtrate from the calcium determination above with hydrochloric acid, concentrate on the steam bath to about 150 ml. made slightly alkaline with ammonium-hydroxide, boil, and filter (to remove a little iron and aluminum, and perhaps calcium). When cool, acidify the solution with hydrochloric acid, add 10 ml. of saturated solution of sodium-ammonium-hydrogen-phosphate, and ammonia, drop by drop, with constant stirring. When the crystalline ammonium-magnesium orthophosphate has formed add 10 ml. of ammonia in excess. Set the solution aside overnight in a cool place, filter, and wash with water containing 2.5 per cent $NH_3$. Dissolve the precipitate in a small quantity of hot hydrochloric acid,

dilute the solution to about 100 ml., add 1 ml. of a saturated solution of sodium-ammonium-hydrogen-phosphate, and ammonia, drop by drop, with constant stirring, until the precipitate is again formed as described above and the ammonia is in moderate excess. Allow the precipitate to stand about two hours; filter and wash as before. Place the paper and contents in a weighed platinum crucible, char the paper slowly, and carefully burn off the resulting carbon. Ignite the precipitate to constant weight over a Meeker burner, or a blast not strong enough to soften or melt the pyrophosphate. Multiply this weight by 0.3621 to find the weight of magnesium oxide.

*Carbon dioxide.*—Weigh out a 5-g. sample and transfer it to a small Erlenmeyer flask. Put this flask in a carbon-dioxide train composed as follows: after the flask comes an upwardly inclined condenser; then U-tubes containing $CaCl_2$, anhydrous $CuSo_4$, and $CaCl_2$; then a U-tube filled with porous soda-lime; and finally a U-tube containing half soda-lime and half $CaCl_2$, arranged so that the $CaCl_2$ comes last. Pour some hot water on the sample, connect the flask in the train and pass a current of $CO_2$ free air through all of the train excepting the soda-lime tubes. Weigh and attach the soda-lime tubes. Through a separatory funnel let some 1:1 HCl into the flask slowly. When any apparent action has ceased, heat the flask gradually to boiling, and continue boiling until no more gas is evolved. Cool gradually. The current of $CO_2$-free air is continued throughout the experiment. Detach the soda-lime tubes, close them, and let them stand in the balance case, weighing them at 30-minute intervals until two successive weighings agree within 0.5 mg. The gain in weight of the soda-lime tubes is recorded as the weight of the carbon-dioxide.

*Non-volatile matter.*—Weigh out a 1-g. sample and ignite to a constant weight in a platinum crucible. The weight of the material left is the weight of the non-volatile matter.

*Calculation.*—The weights in grams of the oxides of calcium and magnesium are added together and multiplied by 200 to reduce to per cent. The weight of the carbon dioxide is multiplied by 20. Each of these figures is then divided by the weight of the non-volatile matter to reduce to the non-volatile basis.

### Physical Determinations

*Fineness.*—Place 100 g. of the sample in a No. 30 sieve which is nested above a No. 200 sieve. Wash the material through the sieve by means of a stream of water from a faucet. Wash until the water comes through clear, but in no case should the washing be continued for more than 20 min. Dry the residue on both sieves to constant weight in an atmosphere free from $CO_2$ and at a temperature between 100 and 120 deg. C. The weights of the residues are calculated to percentages of the sample. The residue on the No. 200 sieve must be corrected by the addition of any material previously removed by the No. 30 sieve.

A small piece of rubber tubing attached to a water faucet is to be used for the washing. The velocity of the water may be increased by pinching the tube, but should not be sufficient to cause any splashing of the sample over the sides of the sieve. Care must be taken not to let water accumulate on the No. 20 sieve, else the openings will become clogged and the operation cannot be completed in 30 minutes.

*Soundness.*—To 20 g. of the sample, 100 g. of standard Ottawa sand is added, mixed thoroughly, and enough water added to the mixture to make a good plastic mortar of rather dry consistency. This is spread on a clean glass plate to form a layer about one-fourth inch thick by 4 inches square. The pat shall be of even thickness throughout, and not tapering at the edges. If the mortar is too dry to work well, more water may be added. The pat is placed in a closet for 24 hours. The temperature in the closet shall be between 65 and 75 deg. F. (18 and 24 deg. C.) and there shall be a free circulation of air but without a direct draft striking the pat. The pat is then soaked in water until a film of water will remain unabsorbed on its surface. If the pat has cracked, the consistency of the mortar was too wet, and a new pat must be made.

Mix 20 g. of the sample with enough water to form a thick cream. Spread this in a thin layer on the surface of the pat. Let stand 15 minutes to permit air bubbles to form. Trowel to an even surface, making this skim coat as thin as possible without allowing the sand to show through. Replace the pat in the closet for 24 hours under the conditions specified above. Suspend the pat in a vessel partially filled with cold water in such a way that the water can boil without touching the pat. Gradually bring the water to boiling and keep boiling gently for five hours, the pat being surrounded with steam during this time. Permit the water to cool for at least 12 hours. Remove and examine the pat.

*Consistency.*—Make the lime into a stiff putty with water and let soak overnight. Mold in a Vicat rubber ring on a glass plate. The needle used is a modified form of Vicat needle, 12.5 mm. diameter and weighing 30 g. It may be conveniently made from a suitable piece of aluminum tubing, the lower end being closed without shoulders or curvature, and the tube loaded with shot to the specified weight. It is mounted in the Vicat needle stand.

The initial reading is taken with the bottom of the needle in contact with the surface of the sample. The final reading is taken 30 seconds after the needle is released. A penetration of 20 mm. shall be considered as standard. If the penetration is less than standard, the sample may be removed from the mold, mixed with more water, and retested. If the penetration is more than standard, the sample must be discarded and a new one prepared.

*Plasticity.*—Plasticity is measured by means of an instrument. Three hundred g. of the sample is mixed with enough water to form a thick putty. After aging in a vessel covered with a damp cloth

for not less than 16 nor more than 24 hours, this putty is adjusted to standard consistency (as defined above), with a permissible variation of ±5 mm.

A Vicat rubber ring lubricated with a thin film of water is placed on the porcelain-base plate of the instrument, filled with the paste, and struck off level. Remove the ring by raising it vertically without distorting the paste. The base plate and paste are placed in the instrument and the carriage turned up by hand until the surface of the paste is in contact with the disk and the distance between the bottom of the disk and the top of the base plate is 1¼ in. The carriage is then thrown into gear and the motor started. It is essential that the motor shall be started exactly 120 seconds after the first portion of the paste is put in the mold. Record the scale reading every minute until the test is completed. The test shall be considered complete when (a) the scale reading reaches 100, (b) any reading is less than the one before, or (c) the scale reading remains constant for three consecutive readings (two minutes) and the specimen has visibly ruptured.

The plasticity figure is calculated from the formula $P = \sqrt{F^2 + (10T)^2}$ in which P is the plasticity figure, F is the scale reading at the end of the experiment and T is the minutes from the time when the first portion of the paste was put into the mold to the end of the experiment.

Much of the success attainable in the plasticity determinations depends upon the condition of the base plates. With continued use the pores of the plates become clogged unless properly cleaned with the subsequent reduction in the rate of adsorption of plates. Therefore, after a plate has been used the excess of lime shall be wiped off and the plate immersed in clear water for not less than two hours, after which it shall be transferred, without drying, to a dilute solution of hydrochloric acid (1:9) where it shall be kept immersed for another two hours. It shall then be washed in running water for at least one hour to remove the acid. It shall then be dried overnight in an oven at a temperature of 100 to 110 deg. C. The plate shall finally be cooled to room temperature before using again.

Plasticimeter base plates when immersed in water at room temperature for a period of 24 hours shall adsorb not less than 40 g. of water. The plates shall be dried overnight in an oven at a temperature between 100 and 110 deg. C. before determining the adsorption. After immersion and before weighing, the excess of water shall be wiped off with a damp cloth. When tested over an area of 2.75 inches in diameter the water adsorbed shall be in accordance with the following:

| | Water adsorbed, ml. |
|---|---|
| First minute | 8 to 14 |
| Second minute | 5 to 7.5 |
| Third minute | 4 to 6.5 |
| Fourth minute | 4 to 6 |
| Fifth minute | 3.5 to 5.5 |

Unless otherwise specified, commercial packages are acceptable. Hydrated lime is usually shipped in cloth bags holding 100 lb. each, or paper bags holding 50 lb. each.

Each bag shall have legibly marked thereon the net weight of its contents, the name of the manufacturer, the place of manufacture, the brand (if any) and some means of identifying the particular contract on which the purchase and shipment were made.

## Illinois Mineral Deposits Explained

On the afternoons of Sept. 8 and 9, at the Western Society of Engineers, Chicago, Ill., Dr. M. M. Leighton, chief of the Illinois Geological Survey, gave a talk upon the geological-engineering features of fluorspar, limestone, dolomite, silica, gravels, sand, fullers earth and clays. He also exhibited specimens, maps and bulletins.

## Geology of Glacial Sand and Gravel

(*Concluded from page 36*)

the brown stones in his deposit are detrimental or harmless to the user? The same answer is returned as in the preceding paragraphs, by going northward to the source of supply. The brown coating is due to the oxidation of iron. If upon the examination of the ledge from which the gravel was derived it is found that it is composed of sandstone whose grains have been bound together with iron cement, the true "rotten stone" condition will appear and the stone will crumble into soft and weak sand, but if the parent ledge is limestone with an insignificant amount of iron disseminated through it, only the outer film will show the brown dust and the heart of the gravel particle will be sound. Many reliable deposits have been unjustly condemned because of insufficient geological knowledge.

The types of rocks that lie northward of morainic deposits influence the size of the fragments. If a limestone has been the chief contributor to the ice-borne debris, a large percentage of gravel and large cobbles may occur in the deposits. This is due to the pre-glacial weathering of the limestone. Because of its easy solubility a limestone weathers deeply along its joint plains which extend downward. This feature tends to produce small and large blocks that are easily plucked off by the glacier.

A granite or gneissic area yields small particles, and sands derived from such outcrops are usually fine-grained. This is because those rocks are very compact and durable and the glacial rasp is able to produce only fine filings.

Inasmuch as glacial deposits of sands and gravels have been and are supplying a large proportion of materials to the concrete trade, a thorough knowledge of their origin, types and constitution as well as their geological history is essential to both producers, users and engineers.

# State Enactment is Sought to Protect Material Men and Laborers

## Subject Discussed at Recent Meeting of the New York Crushed Stone Assn.

THE New York Crushed Stone Assn. met at Albany, N. Y., on August 20 and 21 to discuss the benefits that might accrue to its members from the enactment of certain changes in existing legislation relative to the lien laws of the State of New York.

The preliminary meeting took place at the DeWitt-Clinton Hotel, Wednesday, August 20 at 8:30 p. m., with Royal K. Fuller of Albany presiding. A. S. Owens, secretary of the association, occupied the chair of record. It was the sense of this meeting that materialmen and labor would benefit from the passage of a material-and-labor bonding law, replacing the lien laws now in force, and the salient features evolved were presented by Mr. Fuller at a morning session of the Senate committee in the Senate Chamber at the Capitol, August 21. This meeting was a special session of the committee appointed for the general revision of the lien laws of New York of which Senator Fearon is the chairman and the presentation of the points involved required about three hours.

John H. Odenbach.

The session was attended by members of the association and allied industries representing approximately $100,000,000 in property investment and comprising companies dealing in fine and coarse aggregate, crushed stone and slag. There appears to be little doubt that the suggested changes will receive careful consideration by the committee and that the bill when formulated will be similar in scope to the legislation now in force in the states of Pennsylvania, New Jersey and thirty-three other states, which requires that a contractor bidding on public works must furnish a bond by a reputable surety company as a guaranty of the faithful performance of the contract including specifications and cost of material and labor.

J. D. Fackenthal, an attorney, speaking on behalf of the New York Trap Rock Co., summarized the situation as follows: "An unhealthy state of nervousness exists in the industries here represented, because contractors are not usually worthy, on a strict credit-rating basis, of the amount of credit necessarily extended to them. The materialman is forced to form his judgment of the contractor's right to credit, not on his statement of assets and liabilities but on the man's character and past performance; and materialmen are frequently required to act in the status of a banker to a contractor. In the cases of most public improvements, the lowest bidder is nearly always successful and, faced with this situation, the materialman must foster the cause of the financially weak bidder, who bids low on the theory that he has little to lose, lest some other aggregate producer does the same thing.

"Then the case of the laborer must be cited. In two cases which I have in mind at the moment, labor liens amount to roughly $8,000 in one instance and $10,000 in the other. These unorganized, unskilled laborers are usually known to the employer by a number in a pay-book. Even if they file a lien, they go away to other work in other districts and, if the case is not adjusted in ninety days, the lien must be extended by an application to a supreme-court judge. This is a relatively complicated and expensive procedure when the size of the usual claim for labor is taken into consideration. Also, it must be borne in mind that, whereas these claims are individually small, they are nevertheless important to the laborer and his family and to the merchants with whom he does business."

E. B. Stooks, vice-president of the U. S. Pipe and Foundry Co., Inc., speaking on behalf of the Waterworks Manufacturers Assn., made it clear that he did not think the legislation requested was a panacea for all ills nor was the proposal actuated by purely selfish motives. He pointed out that, even in those jurisdictions where the statutes require a bond, his company does not feel free to sell to every contractor who asks for a quotation. The company is just as diligent in prosecuting a search for credit information in these instances as in cases where the contractor is not bonded. He cited the situation as it exists in his business, in New York City, where the position of the materialmen in dealing with contractors has reached such a point that they will not furnish material without first having an assignment of contract or equivalent protection. He further pointed out the fact, which was confirmed by later speakers, that higher prices are quoted to men who are deemed undesirable credit risks than to stronger men, and the company is forced to pro-rate its losses so that the people in states where the bonding law

is in force carry part of the burden for states where credit conditions are not so satisfactory.

It was pointed out by Mr. Roth that the attitude of the bonding companies had changed materially during the past ten years and that, for the past two or three years, instead of attempting to litigate, as was so frequently done in the past and in many recent cases, they have agreed to carry the contractor for periods up to six months in an endeavor to let him work his way out of his financial tangle. This practice has proved beneficial to all concerned.

Royal K. Fuller, in speaking about the situation as it affects the public, produced numerous photostatic copies of judgments and lien dockets showing instances where as many as 33 liens had been filed on one job prior to last year; for, whereas lienors now take pro-rata, until a year ago the first lienor to file took priority over all subsequent filing. But, even under the present law, the usual effect of filing one lien is to deluge the docket with others, all of which are of little avail because, by the time the first lienor feels that he needs protection, there are nearly always insufficient assets to pay more than a few cents on the dollar, especially after deducting legal expenses.

It was pointed out that, for one laborer who filed a lien, there were many who did not or who could not afford to do so, and therefore an examination of the lien docket in a given jurisdiction was not a true indication of the actual loss suffered. Then there is the intangible loss to the people of the state in cases where the contractors went bankrupt during the course of the building of roads with the result that the entire community and all those having business with it lost time and suffered inconvenience as a result of the long and altogether unnecessary delays.

Mr. Fuller read from page 133 of the report of the Proceedings of the 26th Annual Convention of the American Road Builders Association in Cleveland, 1929, wherein A. E. Horst, then president, cited the great need of a bond of the type now under discussion.

Among other speakers were W. C. T. Davis of the Truscon Steel Co., C. R. Parks of the North American Cement Co., William Boreman of the Boreman Stone Co., T. D. Lynch of the Concrete Steel Co., A. S. Owens of Peerless Quarries, A. G. Seitz of Syracuse, George E. Schaffer of the General Crushed Stone Co., and John H. Odenbach of Rochester, president of the N. Y. State Crushed Stone Assn.

H. R. Hayes, secretary of the Associated General Contractors, spoke in opposition to the proposed measure and said that, whereas his association was not opposed to such a bond *per se*, it would cost the contractors more than $200,000 per annum, that such additional cost was an unwarranted burden on the contractors directly and upon the taxpayers indirectly, and that the situation did not justify such measures. He said there were too many materialmen going into the contracting business as partners with builders, that there was no advantage to the state, that the measure did not guarantee quicker completion of the work, and that it would tear down the present credit structure.

Mr. Andrus of Associated General Contractors suggested that the law should be divided as to private and public construction. Mr. Fuller, in rebuttal to Messrs. Hayes and Andrus, said that labor was in favor of a labor bond, that the condition complained of had been a persistent and recurring evil, and cited the fact that there had been a statutory provision requiring a bond to protect labor on canal construction in the state since 1854.

J. A. Fink, an attorney from New York representing the New York Building Trade Employers Assn., said that he took no position on the measure, but wished to point out that one bond would not necessarily furnish all parties adequate protection when there were several sub-contractors, and he cited the case of Gleasner v. Thompson Starrett Co., N. Y. Reports, in support of his contention.

E. A. Dollard of Syracuse, representing the Syracuse Chapter of the Associated Contractors of America, registered disapproval of sections 36-a and 36-b of the new lien law of the state which is to become effective next October. Under the provisions of these sections a contractor or sub-contractor who diverts funds received for the improvement of real property is guilty of larceny and is criminally as well as civilly liable if he diverts the funds to his own or any use other than that expressly provided in the statute, as the funds so advanced are expressly declared to be trust funds.

The meeting was adjourned until the following morning, August 22, at which time the committee heard further arguments for and against the two sections above mentioned. The substance of this discussion was that the materialmen deemed the sections desirable while the contractors thought them unnecessarily harsh punishment in making the just suffer for the sins of the unjust.

The committee listened attentively to all testimony, promising to consider the matter and to hold further sessions later in the fall, at which time officials of the public-works department would be asked to attend and materialmen would produce further facts, figures and testimony relative to the *modus operandi* of the material-and-labor bond laws in other states.

## Admiral Byrd Will be Main Speaker at Safety Congress Banquet

During the week in which the Annual Safety Congress is to meet in Pittsburgh, Pa.—the week of Sept. 29—numerous entertainments have been planned to relax the delegates between sessions.

Perhaps outstanding will be the Wednesday evening banquet, long one of the institutions of the Congress. Rear-Admiral Richard E. Byrd, who gave one of the finest demonstrations in history of the value of wise planning and careful supervision for safety, and who brought his entire expedition back from a most hazardous venture without a single serious accident to mar his success, will make his first public appearance in Pittsburgh, as the speaker of the evening, following the banquet. Admiral Byrd is one of the world's most renowned safety men, a distinguished scientist, explorer and aviator.

# English Practice Exemplified in Trent Valley Gravel Plant Design

## Location Between River and Railway Presented Unusual Loading Problem

By EDGAR ARMITAGE
Secretary, Goodwin, Barsby & Co., Ltd., Leicester, England

TRENT GRAVELS, Ltd., operate a sand and gravel dredging plant similar to those common in America. This plant is located near Attenborough Station on the L. M. S. line, between Nottingham and Derby.

The deposit is the well-known Trent Valley gravel and must be excavated from beneath water. For this reason it was decided to do the excavating by means of a centrifugal pump, so an 8-in. "unchokeable" pump mounted on a pontoon driven by an electric motor was installed. Designs were solicited by the consulting engineer, A. W. Farnsworth, M. I. Mech. E., of Derby, on behalf of the company, for a plant to deal with the output of this pump. The selected layout was that proposed by Messrs. Goodwin, Barsby & Co., Ltd., of Leicester; and the plant was finally erected with little or no alterations, much of the equipment being manufactured by this firm.

The pump delivers the material into a boiling box situated at the head of a de-watering and de-sanding grid screen about 12 ft. long. The sand and water pass through the grid whilst the oversize passes over it and falls into a large hopper with a capacity of about 5 tons. This hopper is situated over an automatic feeder operating on the reciprocating-tray principle. This, in turn, feeds a 30-in. elevator with continuous and overlapping buckets.

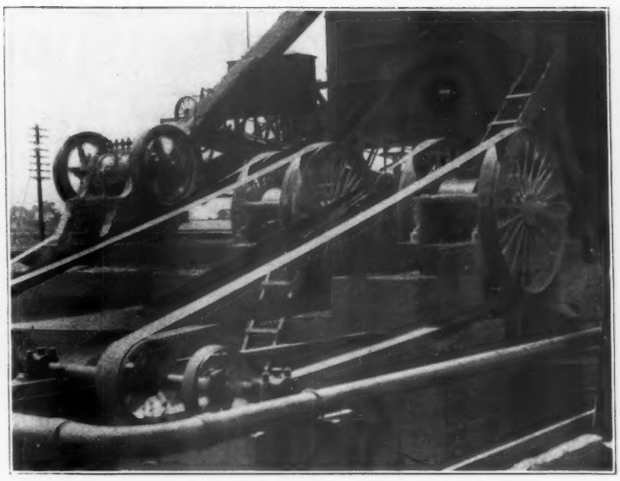
To keep the head of the pump down to the minimum, the elevator was of necessity taken below ground level. The total distance between the working centers of this appliance is 65 ft. and, in consequence, it is backstrand supported.

The screens are of the cantilever type. The process of screening is by rejection of the larger sizes first. The screens are arranged in duplicate, the elevator delivering its material into one chute which splits into two, thus dividing the product, one-half going into one row of screens, and the remaining one-half into the other row. Altogether there are six No. 4 Good-win cantilever screens, three in each line, the perforations being 1½-in. in the two top screens; ⅞-in. in the two middle screens, both of which have an outer jacket perforated with ⅝-in. holes; and 3/16-in. in the two bottom screens. These latter screens are required because the crushed product is delivered into the same elevator, and therefore a certain amount of crushed material has to be dealt with which is equivalent in size to sand.

The material rejected by the 1½-in. perforations falls automatically, by means of a chute, to a

General view of plant with conveyor bridge over railroad.

The sand-dewatering tank.



The granulator and two sets of 30-in. rolls.

30-in. Good-win Granulator, by which it is crushed to ¾-in. and less. It is then delivered to a short conveyor passing under that machine and is carried back into the chute from the feeder to the elevator. The material which passes the 1½-in. perforations and is rejected by the ⅞-in. perforations, falls into a set of 30-in. Good-win rolls set to ½-in. Another set of the same-sized rolls is mounted alongside the first set to take the product that passes the ⅞-in. screen and is rejected by the ⅝-in. screen and crushes it to ½-in. The demand is largely for this particular size.

Both sets of these rolls deliver to the same conveyor as does the Granulator and, in consequence, the material goes the same way and is delivered back to the elevator for conveyance to the screen for re-screening.

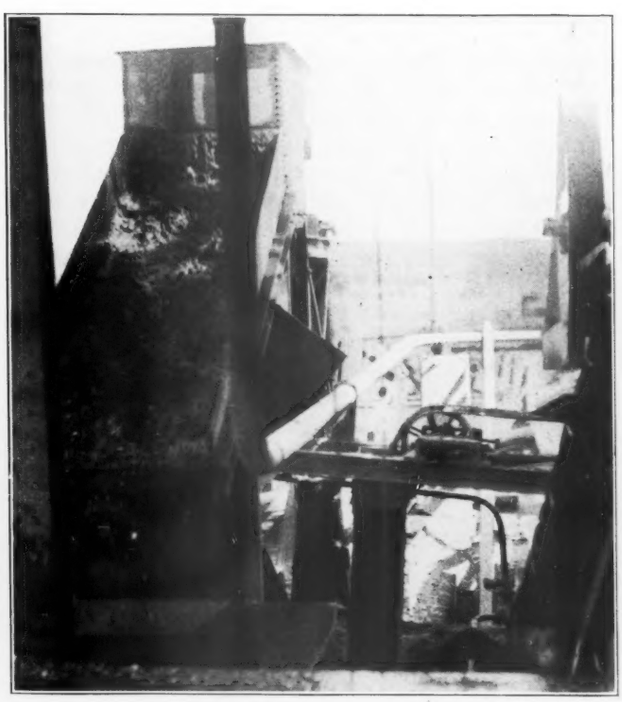
Storage is provided underneath the screens, in overhead bins, for about 60 tons of each size of material. As the pit is located near the railway, a siding was built from the line to pass under the bins and also alongside them. It can be seen that splendid facilities are available for rail transport.

At the same time the lay-out presented considerable difficulty, owing to the fact that the deposit is between the river and the railway, so that all the material which is to be delivered by road must cross this line. The cost of a bridge for road traffic would have been prohibitive while a level crossing was utterly out of the question. A bin was erected, therefore, alongside the road on the other side of the line to accommodate various sizes of product and the material is taken to this bin by conveyors. One conveyor is situated along the front of the plant, and outlet doors from the bins deliver any particular size of material, at choice. This conveyor delivers its product to a second conveyor which crosses the railway line at right angles and delivers into the bunkers alongside the road.

The conveyor running alongside the bins is set at an incline for two reasons. One reason is that this conveyor must deliver to the second conveyor

(*Continued on page* 57)

Dredge and pipe-line on pontoons, as viewed from top of plant.



Boiling box and dewatering grid.

# Technological Aspects of the Soapstone Mining Industry in Virginia*

By C. W. RYAN

WITH the completion of stripping, the quarrying is begun with the following principles in view. Where the vein is wide a wall of soapstone is left on both the hanging-wall and the footwall side of the ledge. The quarry is thus carried down entirely within the formation, the theory back of this practice being that there is less danger of caving if such a barrier is left. The soapstone ledges are not ordinarily of uniform thickness, and in spite of efforts to follow the dip of the ledge, there are areas in which the thickness of the protecting wall is reduced to a point below the shearing and crushing strength of the stone. In such cases the wall cracks and caves, this action being aided by the greasy coating of fine mica which separates the soapstone from the country rock. Caving continues even into the country rock to the zone of strong unweathered stone. Irregular seams in the weathered portion of the soapstone vein also aid in this caving. The handicaps and hazards attendant on the caving are self-evident. Only in wide veins where a thick wall of soapstone may be left standing is this method successful. Even then, as the quarry reaches great depth, the danger of collapse of the walls is imminent, and the history of the industry shows that, in nearly every case, quarries have been abandoned because of dangerous walls.

*The first installment of this article appeared in the August 13 issue of* PIT AND QUARRY *and dealt with the geological and prospecting features of this industry. This concluding installment explains the best practices that have been followed in quarrying and finishing this remarkable stone which has been given many unique fields of usefulness.*

Interesting variations from the practice outlined are known to the writer. In one case the diorite dike that divides the vein longitudinally into two unequal parts was used as the hanging wall. This dike, we are told, stands very well even in very deep quarries because practically all of its seams and cracks cut across the dip of the stone at an angle that gives them a dip slightly more than horizontal and toward the east. The diorite thus stands very much as would a rubble masonry wall. Another variation is the use in narrow quarries of great stulls of oak. Large timbers are lowered into the quarry and wedged into place to support the hanging wall at weak points. The use of these stulls in one quarry allowed the complete working out of the commercial ledge.

The dimensions of quarries vary to some extent, depending on the width of the ledge. They do not generally exceed 100 ft. in width and in length, nor do they often reach a depth of more than 250 ft. There are a few quarries of greater dimensions, but the majority are smaller even than those mentioned. The low limit is about 30 or 40 ft. in width and 60 or 70 ft. in length. Some of the narrow quarries have been carried down about 200 ft., and some of them have maintained a length of 100 ft. Where the workable ledge warrants the opening of several quarries in line, the practice has been to leave a bridge wall from 25 to 40 ft. thick between adjacent quarries. This bridge wall serves as a support for the hanging and footwall of the quarry. After adjacent quarries have been worked out, the bridge wall, which is of a commercial grade of stone, is sometimes worked until danger from caving walls makes further work prohibitive.

### Quarrying Practices

Channeling machines are employed to slice the stone at right angles to the strike of the ledge. These are called "layer cuts." Channeling machines are used also in making "end cuts" at the hanging and footwall sides of the quarry. Undercutting machines are used to make the bottom slice of each layer. The layers are rectangular prisms of stone 48 in. wide (not including the 2-in. channel cut on each side), 90 in. deep and as long as the quarry is wide. The 90-in. is the depth of each "floor" of the quarry, and the 48-in. is the width of each layer.

In order that the undercutters may be brought into use, a "gateway" must be cut and removed. This gateway consists of two or three layers chosen at the middle of the quarry. Enough stone must be removed from the gateway to allow the undercutters to function both in severing the remainder of these layers and the adjacent ones. After the end cut is made along the hanging wall, a channel machine is set to work cutting out a wedge at the end of the gateway layers. This wedge is cut so as to taper in the direction of the strike of the stone as well as that of the dip, and has the cross-section of a trapezoid. The wedge is made unsymmetrical in order that it may be removed more readily by the chain and derrick. A symmetrical wedge is more difficult to remove than an unsymmetrical one. After the cutting of the wedge, the channel machine slices the stone across the layers for the whole length of the gateway.

After the removal of the wedge, which is accomplished by use of a chain and derrick, a jackham-

* Reprinted from Technical Publication No. 160, American Institute of Mining and Metallurgical Engineers.

mer is put at the bottom of the opening thus made and numerous holes are drilled into the sliced layers in the gateway area. These holes are drilled to accommodate the "plugs and feathers" which are driven in to split off the first few blocks of stone. The feathers are two pieces of half-round steel which are inserted into the drill hole. The plug is a steel wedge of long taper which is inserted between the feathers and is driven until the block of stone is split off. This procedure is followed until enough space has been cleared in the gateway to accommodate the undercutting machine. The undercutter finishes the severing of the remainder of the stone in the gateway and makes the bottom slice of the other layers for the whole length of the quarry. The opening of the gateway is by far the most tedious part of the quarrying operation, as is evident. As the use of high explosives is considered unwise in soapstone quarrying, because the stone is easily shattered, the slow method described is the only one now used. The removal of the gateway in the average quarry takes about as long as the removal of the rest of the floor.

### Blocking Out

With the gateway cleared and the undercutters going at full speed, the channeling machines must be worked constantly to keep ahead of them. Consequently channeling out the blocks across the layers is not thereafter continued. The stone is broken with the grain into blocks of the desired size by means of the plugs and feathers, as described, with the difference that holes are drilled in a row along the dip of the stone in a direction parallel to the strike. The stone having already been severed in five planes, and only one more face remaining to be exposed, the splitting of the block from the rest of the layer frees the stone and it is ready to be removed by the derrick.

In deep quarries practically all of the material is removed in the manner described but, before depth is reached, a large volume of loose, broken stone and dirt must be handled. This is shoveled, either by hand or by some mechanical shoveling device, into a large steel "mud-pan" of rectangular shape, open at one end and at the top and fitted with four rings so that it can be handled by the derrick. Its capacity is 1¾ cu. yd.

### Waste Disposal

The disposal of quarry waste is a most serious and important question. Unless proper facilities are provided, the cost of production at the quarry grows to unprofitable proportions. The dump is usually situated near the quarry, if sufficient elevation for dumping is available. Quarry waste is handled in side-dump railroad-construction cars, loaded directly from mud-pans. It is poor policy to dump waste close to the quarry—that is, within the swing of the derrick—as its weight, if piled high, will increase the possibility of slides within the quarry. Abandoned quarries are often used to accommodate waste.

Most quarries are subject to a flow of considerable ground water and a pump must be operated in the gateway at least half the time. The pump is usually installed on the wall above the working floor and the water is drawn out of the gateway sump by a suction hose.

After the blocks are removed from the quarry they are passed upon for quality and usefulness. They are then put on the reserve pile, or on flat cars and transported to the mill. The stone that is condemned is thrown over the dump. All the good blocks are painted with a serial number, of which record is kept at the quarry by the foreman and a copy sent in the form of a report to the mill.

The location of the derrick is an important task, as success in handling the stone depends entirely upon it. The site must have a solid base, to avoid hazard of slides. This is quite a problem, for the nature of the hanging wall and the footwall at shadow depths is frequently not thoroughly understood. The footwall has frequently been chosen, the hanging wall less often. The bridge wall is generally unreliable because of numerous seams which cut the formation in the weathered zone. These seams have an inclination, which causes the base of the derrick foundation to work over the edge of the quarry. There are instances, however, in which derricks have stood for a long time on the bridge wall with entire satisfaction. Local conditions of the stone are the determining factor.

### The Milling of Soapstone

Soapstone blocks are brought from the quarry and are deposited with the reserve supply at the mill or are loaded on gang cars. These blocks are handled by the mill derrick, which is conveniently located so as to serve the gang saws, the reserve block pile and the mill stock piles. The blocks are handled with the same chains that are used to hoist them out of the quarry, if the blocks are sent directly from the quarry to the mill; the chains are left around the blocks throughout their handling until they finally reach the gang cars. This practice obviates the necessity of rechaining the blocks every time they are to be moved, and thus facilitates their handling. The chain is made of ¾-in. round steel with a 6-in. steel ring of 1-in. steel at one end, and is about 30 ft. long.

After being placed upon the gang car the block is aligned and wedged in place so that the sawing will take place in a plane parallel to the grain or schistosity of the stone. The sawing is easiest and quickest in this direction and, for the majority of uses, slabs thus sawed are the only stock that can be used.

The gang saw consists of a rectangular frame of heavy steel about 6 ft. by 12 ft. inside dimensions, across the longer dimension of which are stretched and wedged steel bands of ⅛-in. by 2-in. or 3-in. cross-section. These steel bands are spaced to give slabs of the desired thickness, this being, in general, slightly over 1¼ in. The saw is driven by a camshaft and the framework is supported from

above by hangers, which are attached to screw feeds so regulated as to lower the framework in proportion to the speed of cutting by the blades. The cutting medium is either sharp sand, round sand or steel shot. Round sand is generally used. The speed of cutting the block depends on the size of the cutting particles and the hardness of the stone. The time varies from 12 to 24 hr.

The next operation is that of cutting the slabs into the proper shapes and sizes. This is done by the cut-off saw and the rip-saw, under which the slab is moved on a mechanically-operated carriage. These saws are circular; they are generally faced with carborundum although, at times, toothed saws are employed. The latter are used for very soft stone. The cutting off and ripping of the slabs to the required dimensions are done with the carborundum saws as these saws leave the polished surface desired.

### Rubbing and Polishing

After the slab has received its initial shaping it is put on the rubbing bed, where it is brought to the proper thickness. The rubbing bed consists of a circular table of steel which revolves around a central shaft. The grinding medium is crushed steel shot, which flows in a closed circuit. The flow from the table to the sump is by gravity and from the sump the shot is elevated to the table by a spiral lift. An excess of water in the sump carries away the slime. The slabs are held on the table by a wooden framework arranged to move the stone centrally across the table. This prevents the slab from being scored by particles of grit which may become lodged under them. The rubbing bed gives a rather sandy finish. If a smoother surface be desired, the stone must be subjected to polishing processes.

When the stone must be given a very smooth finish, it is polished by a buffing machine. Several grades of carborundum are used on the machines, according to the finish desired. The polishing is done wet, as are all the other fabrication processes described except the drilling and countersinking.

From the rubbing bed the slab is conveyed to the grooving machine, drill-press, or whatever machine is necessary to give it the final shape required for its particular use. It then goes to the assembling room, where the various parts are bolted together and cemented, or are packed separately for shipment.

### Soapstone Products

The milling processes described are employed in the manufacture of switchboards, laundry tubs, sinks, table tops, stair treads, lavatory equipment and other products of a similar grade. When the product is to be of a less finished nature, the steps in its fabrication are less numerous. Firebrick and furnace linings, for instance, are made by sawing the stone under the gang saw, sawing transversely with the diamond saw and planing with a steel planing machine. Fireless-cooker disks are made by sawing the slab into square plates and then cutting out the circular disk on a lathe. These are countersunk on the drill press.

### Grades Used for Various Purposes

The grades of stone suitable to the various uses are distinctive. For electrical equipment a medium-hard stone free of minerals that conduct current is required. The foliated, massive variety found in the middle vein is generally used for this purpose, although it is sometimes difficult to obtain stone free of siderite. The west vein in certain places has furnished the most satisfactory stone for this use. For table tops and laboratory equipment the stone must be free of both siderite and calcite veinlets. The reason for this is obvious, for the value of the stone in such uses is directly dependent on its ability to resist acids.

Stair treads are made of the harder variety of stone, particular attention being given to uniformity of hardness which will give an evenly-wearing surface. Soapstone used for this purpose wears to a smooth surface from which scars are easily erased by subsequent wear. It does not easily break off at the edges and the wear to which it is subjected seems to compact the surface rather than to abrade it. It is claimed that the stone from some of the quarries has greater lasting qualities than marble.

When the stone is to be used for purposes in which it is subjected to moderate heat, the soft varieties are commonly used. All soapstone has a remarkable faculty for retaining and resisting heat, and it is only in uses which require the application of excessive heat that attention must be paid to the texture. For use as firebrick, furnace lining and firebacks, the most satisfactory grade seems to be that of an open texture. Apparently the porosity of the stone offsets the differential expansion which takes place when great heat is applied to a stone of complex mineralization. This stone, being relatively free of carbonates, is less liable to be fused and to exfoliate than the more compact varieties in which the presence of these elements is more common.

### Physical Properties of Soapstone

In general, it may be said that the selection of stone for the various uses is influenced by the absence of certain objectionable features rather than by the presence of the useful characteristic features. Thorough study of the wearing qualities, the heat retentiveness, fusibility, conductivity, chemical resistance and similar features is necessary to determine the commercial value of the body under observation. The heat retentiveness of the stone is one of the qualities that brought it to the notice of the early users. In the old days it was used as a hot-plate to be carried on long winter journeys in horse-drawn vehicles. This plate, it is said, retained a greater portion of the heat applied for a period of 24 hours. This same quality made it useful as hearthstones, firebacks for ovens, griddles, and other domestic purposes.

Since the development of the industry, soapstone has received recognition as a good substitute for furnace brick, the temperature of fusion being very high. Also, it possesses the quality of not being susceptible to spalling or crumbling, and it is

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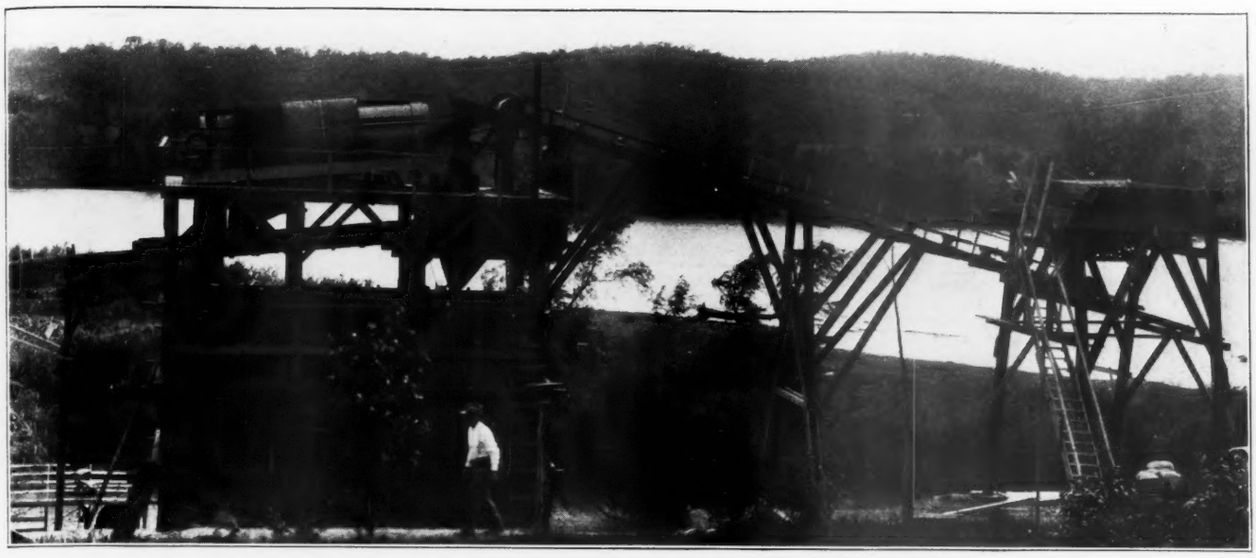


The Phoenix plant, as viewed from hillside, and gravel bar in background.

# New Aggregates Plant Dredges From Bar in Osage River, Missouri

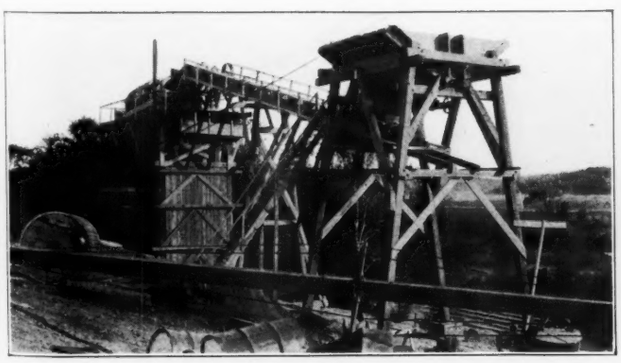
## Gravel Pumped to Sump and Re-handled to Plant by Stiff-Leg Timber Derrick

THE Phoenix Sand & Gravel Co. recently put into operation a new sand-and-gravel-dredging and screening plant at Warsaw, Mo. It is a small plant with a capacity of 100 cu. yd. per hour but is of modern design and construction and has several unusual operating features.

The plant is located on the bank of the Osage River in the city of Warsaw, about 35 miles south of Sedalia. The deposit is a bar in the river which covers about five acres and is known to have good material to a depth of at least 18 ft. with no overburden. The material is about 40 per cent sand with less than 1 per cent of the gravel being over 2-in. in size. The deposit is being worked by permission of and under lease from the county in which it is located.

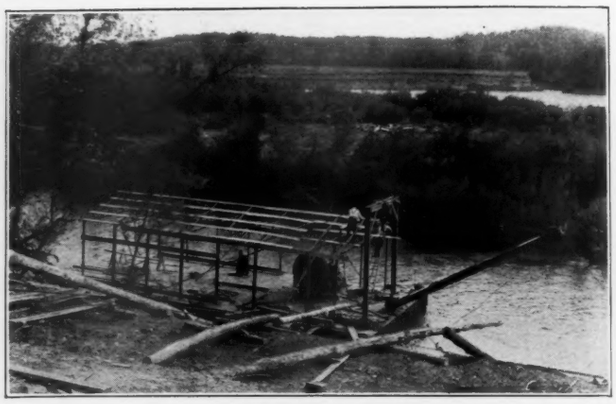
The dredge has a single-compartment steel hull with three bulkheads and is 56 ft. long by 24 ft. wide. It has a structural-steel-framed superstructure and was built by the American Steel Dredge Co. The 12-in. Amsco centrifugal pump is driven by a 300-hp. 2300-volt Westinghouse motor. The 30-ft. intake is handled from a steel boom by an Orr & Sembower 3-drum hoist which also operates two shore lines. The pump has a 12-in. intake and 10-in. discharge.

The dredge line is supported on steel pontoons furnished by the American Steel Dredge Co. Black iron pipe, Amsco pipe-bends, Philips & Daviess adjustable hose clamps, and Victor L. Phillips Co. heavy-duty suction-hose are used. Power is trans-



Plant and hopper, with derrick boom in foreground.

Single-drum hoist and 3-drum hoist for the derrick.



Dredge under construction, with the 12-in. pump in place.

Stiff-leg derrick equipped with 3-drum hoist.

mitted to the dredge through a General Electric submarine-type, lead-covered cable.

The dredge line discharges into a concrete sump, 12 ft. deep, 22 ft. wide, and 40 ft. long, cut into solid rock in the side of the hill at an elevation of about 23 ft. above the normal river level. The outlet from this sump is on the river side and takes the overflow water, together with the silt and fine sand, through a flume back into the river.

An American Hoist & Derrick Co. stiff-leg timber derrick with a 65-ft. boom handling a 2-cu. yd. Owen clamshell bucket handles the material from the sump to the plant. A Lambert 3-drum hoist driven by a 100-hp. Westinghouse motor operates the boom and bucket. A Clyde single-drum hoist swings the boom.

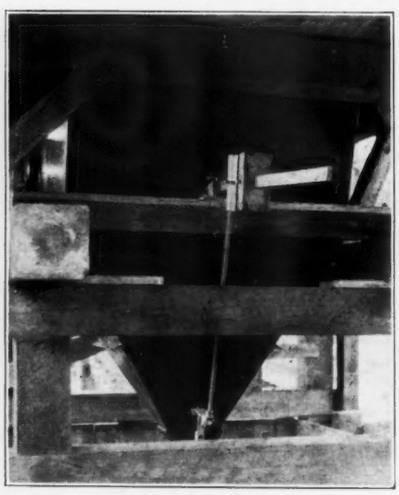
The derrick discharges the material to a 15-cu. yd. capacity steel-lined wooden hopper. A Telsmith plate feeder discharges to a Telsmith 24-in. belt conveyor on 56-ft., 6-in. centers. This feeds the 5-ft. by 16-ft. Telsmith double-jacketed revolving screen which has a 5-ft. scrubber section. Three sizes of material are produced, road gravel, pea gravel, and sand. The two large sizes go to bins while the sand goes to a Telsmith 8-ft. sand settling tank which separates out the fine sand and silt.

The timber bin is divided into three compartments with a total capacity of 125 cu. yd. These discharge through three Telsmith quadrant-type gates on each side. For a time truck shipments only will be made, although a siding to a nearby railroad will be installed later.

Wash water for the plant is furnished by a Hill Pump Co. 8-in. centrifugal water pump driven by a General Electric 75-hp. motor. A special substation was installed for this plant by the Missouri Public Service Co. Power is reduced from 22,000 volts to 2,300 volts for the dredge pump motor and to 440 volts for the plant motors. A transformer on the dredge lowers the pressure to 440 volts for the smaller motors.

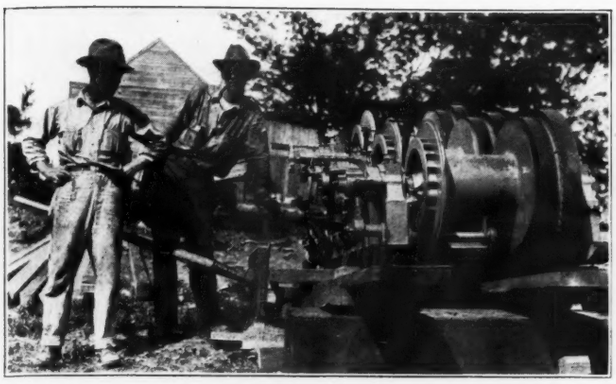
The dredge was designed and built by the American Steel Dredge Co. and the plant by the Smith Engineering Co., which also furnished all plant equipment. The erection of the plant was under the supervision of Ed. Armstrong, superintendent of the plant. Mr. Armstrong also supervised the location and erection of the sump and derrick. Goodyear conveyor belting and Leschen Red Strand cable are used. The concrete footings for the derrick and the plant are embedded as much as 6 ft. in solid rock.

Plate feeder to conveyor under the hopper.



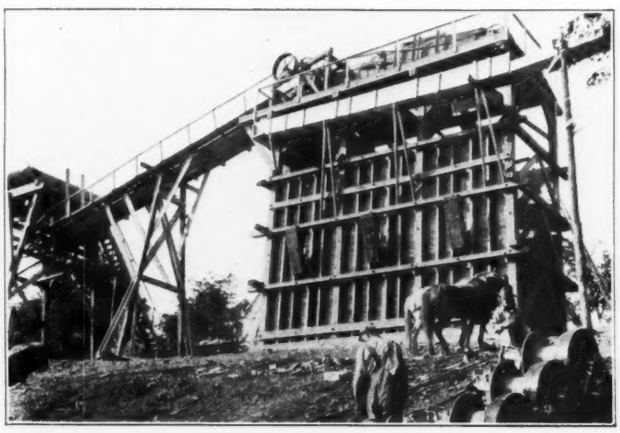
Close-up of 8-ft. sand-settling tank.

Revolving screen, scrubber section in foreground.



Ed. Armstrong beside the 3-drum hoist for the dredge.

The Phoenix Sand & Gravel Co. also operates four other sand and gravel plants in Missouri. One of these is in Warsaw also, one is at Westphalia, and two are at Bagnell. The last two are also on the Osage River, about 80 miles upstream from Warsaw and are furnishing material for a $32,000,000 dam, one of the largest in the world, which is now being built near Bagnell.



River side of plant, showing drop-chute gates.

The main office of the company is at 307 Monroe Bldg., Jefferson City, Mo. Officers and personnel are: Burrel McInerney, president; Jess Perkins, vice-president, general manager and general superintendent; C. I. Vick, purchasing agent; and Carl Opie, chief engineer.

## English Practice Exemplified In Trent Valley Plant Design

(*Continued from page 51*)

at a level sufficiently high to allow ample overhead clearance for the rail traffic on the main line. The other reason is that this conveyor is continued down to the ground level at the lower end and is equipped with an automatic feeder so that material from the ground storage can be "grabbed" onto it. Any particular size, or sand from the de-watering tank which is, of course, on the far side of the railway, can, by means of this feeder and the conveyor, be delivered into the road bins.

It will be understood that the problem of getting this bridge across such a busy railway line required careful consideration as, even on Sundays, the utmost time that could be allowed by the railway company was about one-half hour. This feat was accomplished with even a little time to spare.

The sand and water, both from the grid over which the pump delivers and from the screens, passes by chutes to a sand de-watering tank built of timber on a troughed concrete base. In the trough is a bucket elevator with special buckets whereby the sand is dredged from the water whilst the overflow runs over one end of the wooden tank and back, through a long launder, to the pond whence the gravel is excavated.

Altogether this tank has to deal with the water delivered by the 8-in. pump and with that delivered by a 5-in. pump driven by a 40-hp. motor which provides fresh water for spraying the screens.

The plant is built entirely of steel, and the capacity is about 75 tons per hour.

## Large Railroad Construction Program Planned in Southwest

The Santa Fe System announces the projected construction of 380 miles of new railroad at a cost of approximately $15,000,000. The lines will be in Colorado, Oklahoma, Texas and New Mexico. One line will be built from Amarillo to Las Animas, Colorado, a distance of 220 miles; a second line from Felts, Oklahoma, to Colmor, New Mexico; a third line from Spearman to Dumas, Texas.

## Technological Aspects of Soapstone

(*Continued from page 54*)

very easily worked. Soapstone absorbs only a small amount of moisture and grease and can be cleaned easily with sandpaper, which makes it popular for laundry tubs and griddles. After the discovery that the pure stone was a nonconductor of electricity, it came into use for switchboards and various types of insulators. Its acid-resisting qualities have made it almost indispensable in chemical plants and laboratories. It is used in lavatories on account of its durable qualities and the possibility of cleaning it easily, its color making it suited to that use.

The harder varieties of stone have come into use as stair treads, table tops and wainscotting. It wears well and evenly and the edges are not easily broken. The stone takes a good polish quite readily, a factor which, coupled with its color, makes it suitable for trimming in interior decoration. In the past soapstone was used quite extensively for building purposes, as a substitute for brick and in foundations but, at present, not much is thus used, though certain of the granular varieties have found much favor and considerable actual use by architects as a facing or veneer in stone structures. It is not, however, used economically for the body of walls nor in large quantities for interior facing.

# How Rock Salt Excavated from a Mine Is Processed for the Market*

By H. D. KEISER

CREDIT for pioneering in the adaptation of mechanized mining and processing operations in the rock-salt industry may justly be granted the Detroit Rock Salt Company. Economic circumstances were undoubtedly important contributing factors in influencing the company to utilize labor-saving equipment wherever possible. However, a particularly difficult economic situation that would naturally make economy in labor advisable could not be entirely responsible for the unusual efficiency readily apparent in the operations at the property —this must be attributed solely to a capable and foresighted management.

The hoist house at No. 2 shaft is exceptionally clean, besides being well ventilated and lighted. The hoist and motor, in addition to the floor and walls, are painted a light gray and are kept spotless.

The cylindrical winding surface of the Ottumwa hoist is 16 ft. long and 11 ft. in diameter; the smaller portion of the conical section of the drum is 8 ft. in diameter. A 1½-in. hoisting cable is used. Power for the hoist is supplied through Sykes herringbone reduction gears by a General Electric Type-MT-20 induction motor. This motor is rated at 600 hp., at 350 r.p.m., under full-load conditions; a 4,600-volt 60-cycle alternating current is employed.

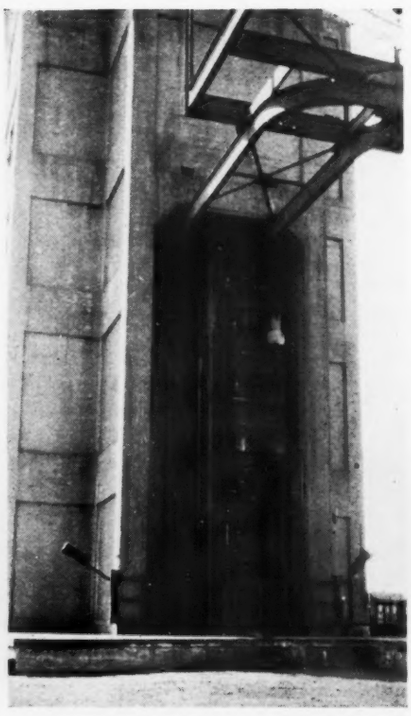
The 6-ton skips used at No. 2 shaft are hoisted to the top of the headframe, where they are automatically dumped into the skip-bin. This bin is built of steel and concrete, and is an integral part of the headframe structure. Preparation of the salt for the market consists of subjecting the salt, as mined, to a series of crushing, picking, and screening operations. These are performed in two buildings known as the "new breaker" and "old breaker" buildings, which are connected by a 200-ft. conveyor gallery. Primary and secondary crushing, as well as initial screening and picking operations, are housed in the new breaker building. This building was designed by the Allen & Garcia Co. Operations in the old breaker building comprise re-crushing, final picking and screening, and shipping. A surface crew of 45 workers is employed.

Consumers of the various grades of salt produced by the company include meat packers; ice-cream manufacturers; chemical and water-softening plants; steam and electric railways, for melting snow and ice; railroads, in connection with the icing of refrigerator cars; and manufacturers of tile and clay products, for glazing purposes.

As indicated in the flow sheet, the salt, which varies in size from 18 in. to fines, passes from the skip-bin, in the new breaker building, onto a 4 ft. by 8 ft. Weller rotary grizzly, spaced at 6 in. The oversize falls onto a 48-in. belt conveyor equipped with a Dings 24-in. magnetic head pulley. This pulley removes (1) the loose pieces of iron detonating wire that are mixed with the salt as a result of electric blasting; and (2) any larger pieces of tramp iron that may be present. The conveyor discharges into a Kennedy-Van Saun jaw crusher, where a reduction to 6 in. is effected. A 30-in. by 24-ft. picking belt, which receives the products of the jaw crusher, discharges the salt into a Pennsyl-

*Reprinted from *Engineering and Mining Journal.*

New breaker building from west.



One of the 6-ton skips.

New breaker building, looking north.

vania corrugated single-roll crusher. The undersize from the Weller grizzly is fed, in equal portions, to two ¾-in.-mesh Hum-mer screens, the oversize of each of which passes onto a 30-in. by 24-ft. picking belt. On leaving the picking belt, the salt joins that from the Pennsylvania crusher and enters an 8-ft. by 24-ft. Bradford rotary breaker, equipped with 1-in. perforated plates. The minus 1-in. product of the breaker joins the undersize from the Hum-mer screens and passes into a mill bin. From the bin, the salt is discharged by a Weller reciprocating feeder onto a 3-in. by 200-ft. belt conveyor. This conveyor discharges onto a 30-in. by 50-ft. cross conveyor, which, in turn, discharges into a 50-ton bin in the old breaker building.

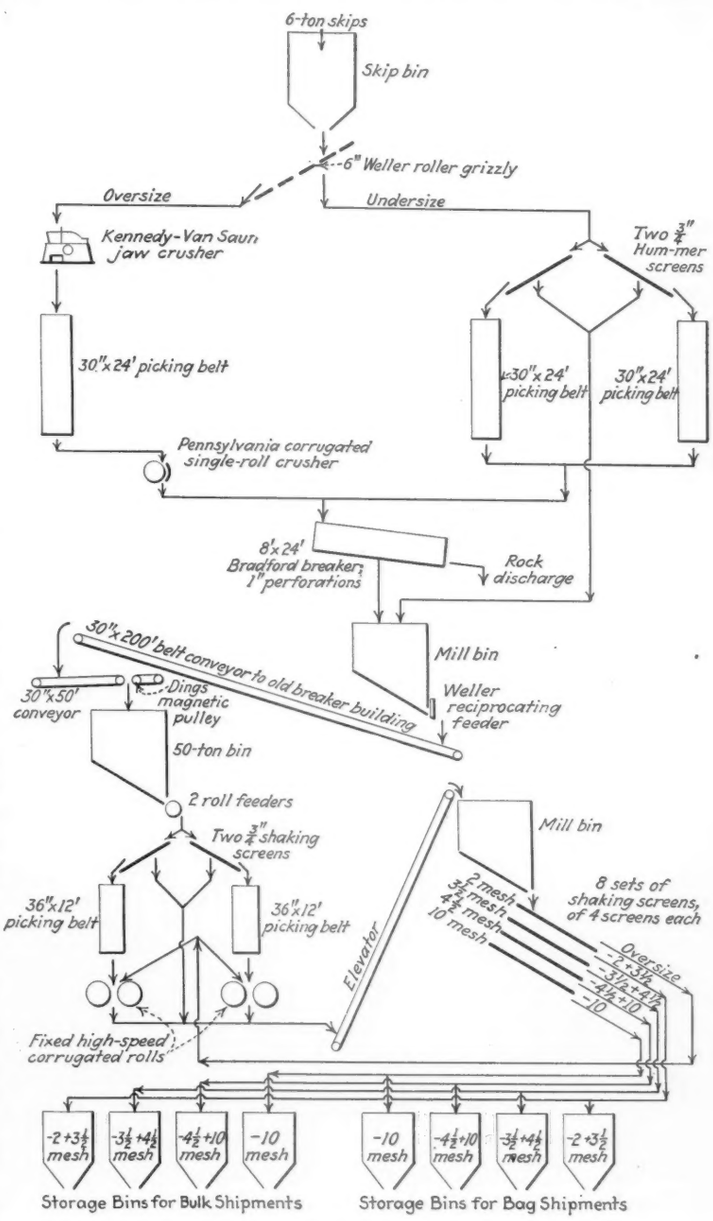
A Dings magnetic pulley, opposite the discharge end of the cross conveyor, removes small pieces of iron that may have been imbedded in the salt prior to crushing, as well as short lengths of detonating wire. The salt is fed from the bin by two roll feeders onto two ¾-in. locally-made shaking screens, the oversize from each of which passes to a 36-in. by 12-ft. picking belt. Each picking belt discharges into a set of 12-in. by 24-in. corrugated high-speed rolls, the roll product joining the undersize of the shaking screens and passing to an elevator that discharges into a bin. From this bin, the salt is fed to eight sets of shaking screens, each set consisting of four screens.

The top screen of each set is a 2-mesh screen. Under that is a 3½-mesh screen, next a 4½-mesh screen, and then a 10-mesh screen. Oversize of the 2-mesh screens is returned to the two sets of corrugated rolls. The four products of the screens—namely, minus-2-plus-3½-mesh, minus-3½-plus-4½-mesh, minus-4½-plus-10-mesh, and minus-10-mesh—are stored in two sets of bins, one for bulk shipments and the other for bag shipments.

Both bulk and bag shipments are made in boxcars. In bulk loading, the salt is drawn from the storage bins into the hopper of an automatic car-loader of the conveyor type that can be moved from one car to another along an overhead support as loading proceeds. Salt for bag shipment is drawn from the bag-storage bins into the hopper of a weighing scale. The bags are filled with the desired quantity and then sewed. Belt conveyors transport the bags to the shipping platform, where they are loaded into cars.

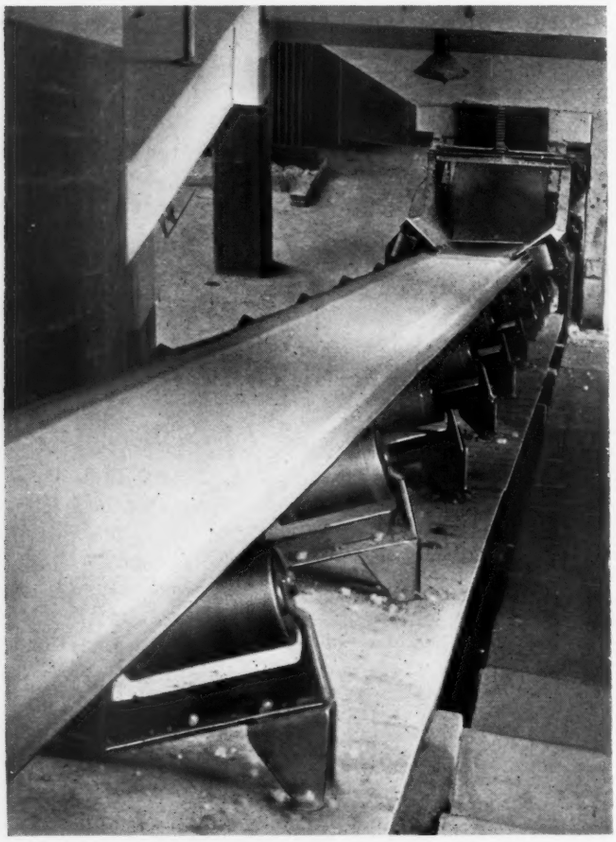
The treatment practice employed by the company in preparing the crude salt for the market includes the application of much equipment of special design that is indicative of the efficiency and progressiveness of the management. In exemplification of this may be cited the unusual construction of the conveyor idlers. Corrosion is an arch enemy at any salt plant. Although its usual effect is to cause an early scrapping of equipment, corrosion may interfere with operations and affect the quality of mill products. Such, at least, was the situation at the plant of the Detroit Rock Salt Co. several years ago, when the customary plain steel idlers were in use on the various conveyors. Serious corrosion and incrustation occurred on the contact surfaces. Incrustation not only interfered with conveyor operation and increased the wear on the belts, but also, when it flaked off, contaminated the salt that was transported on the belts. These difficulties were avoided by replacing the plain steel idlers with Link-Belt "granitized" idlers of the anti-friction type. The granitized or porcelain-enameled surfaces of the idlers removed the possibility of corrosion and hence of incrustation.

Much of the equipment in both the new and the old breaker buildings is driven by individual motors. The electric power is obtained from the Detroit Edison Co. and is brought onto the property at 4,600 volts. Power for underground use is converted to lower voltages at the bottom of No. 2 shaft; that for surface use is reduced in the transformer room.




**Flow sheet of Detroit Rock Salt Co.**

In addition to the two breaker buildings and structures at the two shafts, surface plant includes a 24-ft. by 60-ft. change house, a 30-ft. by 60-ft. stock-room building, a 40-ft. by 120-ft. shop building, and an office building. Cleanliness, similar to that referred to in describing the interior of No. 2 hoist house, prevails in all these buildings.



**Reciprocating feeder to conveyor that connects old and new buildings.**

Before the visit to the property was concluded, it was apparent that the unusual cleanliness of which mention has here been made was not merely the result of an extraordinary amount of labor expended on cleaning-up operations, but rather represented co-operative effort on the part of the personnel not to permit the property to become untidy in any respect. In discussing this subject with the late G. W. Hain, formerly general manager, he said: "Keeping the property cleaned up has paid from the start. In fact, the sale of the scrap collected when we started to clean up the property some years ago paid all the costs involved in collecting the scrap and in placing the grounds in the condition in which you now see them." The guess is hazarded that, in this forceful attitude against untidiness, with which the entire personnel of the company seems to be imbued, may be found the fundamental reason for a large portion of the company's efficient and successful management.

## Separation of Quartz and Feldspar is Possible by Flotation

Quartz and feldspar constitute a large part of the earth's crust and also are the most widely distributed of all minerals, says the U. S. Bureau of Mines. The uses of these minerals are almost innumerable as, when pure, they are much sought and command a relatively high price.

Feldspar and quartz not only occur contaminated with other minerals, but invariably are found together, generally quite intimately intermixed. These facts, especially the latter, account for the present market status of these minerals in spite of the universal distribution and unlimited quantities of the same.

Feldspar is obtained in commercial quantities from especially favored localities where certain portions of the earth's crust cooled very slowly, thereby causing the feldspar, and quartz to a lesser extent, to form in relatively large pure crystals. These large crystals of pure feldspar are hand-picked from the mixture of minerals. At present, this is our only source of pure feldspar. There is need, therefore, of a method of mechanical separation for treating the vastly larger supply of quartz-feldspar minerals which cannot be hand-picked because the component minerals are too finely dispersed. Hence, a commercially feasible process for the separation of quartz and feldspar would not only reduce the present cost of feldspar, but also afford a supply of quartz, for in a general way, what has been stated concerning feldspar applies to quartz. Therefore, an efficient mechanical method for the separation of quartz and feldspar would result in obtaining two useful commodities from an at-present worthless material.

In order to assist the mining industry to devise a commercially feasible process for the separation of quartz and feldspar, the Intermountain Experiment Station of the U. S. Bureau of Mines, in cooperation with the Dept. of Mining and Metallurgical Research of the University of Utah, Salt Lake City, U., has made a study of the problem and, as a result of the work that has been done, it is believed that a method has been devised which will meet the requirements. Moreover, in connection with the work, considerable data have been obtained which will be a distinct contribution to our present knowledge of flotation. It was found that carefully controlled, minute amounts of certain reagents would cause the feldspar particles to float and did not affect the quartz similarly. By this treatment 90 per cent of the feldspar of a quartz-feldspar ore was floated and this flotation product contained more than 90 per cent feldspar. The necessary quantities of the reagents range from a few hundredths to one-half pound per ton of ore. These reagents are all relatively inexpensive and are easily obtained.

Further work is to be done on this problem, and later the results will be published in the form of a technical paper.

# Conservation and Development in the Bauxite Industry in France

By FRANCIS M. MANSFIELD

FRANCE is finding new uses for bauxite by the increased transformation of it into aluminous cement and the fabricating of colored wall revetments as a substitute for the more expensive ceramics, tiles and glass, thus giving the exploitation, or extraction, of this really valuable material a new impetus and enlarged profits.

The project of a new French law respecting bauxite deposits and their exploitation may possibly close such sources of supply to the outside industrial world, if not permanently, at least temporarily. The principal tenet of the project is that no change may be made in ownership or concession rights in the extensive bauxite fields of southern France for a period of five years.

Bauxite deposits, as defined by law, are all such as contain in exploitable quantities bauxite with an alumina content above 45 per cent and containing less than 15 per cent sil.

The development of the French bauxite industry to date has been remarkable in that it has served to nourish many foreign plants producing aluminum metal in Switzerland, in Germany, and in Great Britain. Small quantities, a dozen or twenty years ago, were shipped to the United States but this traffic has almost entirely ceased.

The chief use to which bauxite was hitherto put in Europe was for the production of aluminum metal, of which the automobile industry was originally the largest consumer, followed later by makers of household utensils, and still later by the electrical industries, which found its conductivity and adaptability in excess of that of copper for many uses.

The real bulk consumption of bauxite in France in later years—beginning practically with the opening of hostilities in the World War—has been for the making of alumina cement, or *ciment fondu.* The French army during the war had constant reserves of 300 metric tons for the quick laying of gun platforms, roofing of dug-outs and shelters adjacent to the trenches.

Not even the super-cements—though adaptable in many cases because of their lower price—have been able to affect the growth of this new aluminous-cement industry. It uses bauxite of a lower alumina content and a greater volume of silicate than that which produces aluminum metal.

Resources of bauxite of all grades in southern France—in a territory running from the Italian frontier, and skirting the Mediterranean, east of Toulon to the west of Montpelier, approaching the Spanish border—are, if not inexhaustible, at least inestimable at the moment.

The discovery of the valuable properties of *ciment fondu* (now selling at 493 francs per ton metric as compared with 310 francs per ton for first quality Portland) by Jules Bied, a French savant a quarter of a century or more ago, has revolutionized many engineering and construction problems.

He was really looking for a binder which should be indecomposable by sea water and resistant to sulphurous waters. This was finally found, through much research in interior and exterior laboratory work, by the fusion of bauxite in an electric furnace.

The content of the French La Farge ciment fondu—the "type formula" which other makers seek to attain—stands as: silica, 10 per cent; alumina, 42 per cent; lime, 42 per cent; iron, 2 per cent.

It seems probable that, with all the virtues of aluminous cement, such as rapid hardening, enabling plant machinery, street pavement crossings, railway platforms and what-not to be used on the morrow instead of a month later, and its resistance to sea-water and sulphur water, for bridge and pile work, an even more rapid growth of the industry in the United States is imminent, above all considering the great extent of available deposits of bauxite of high silica content in the middle west. Taking a leaf out of the book of French experience suggests that this should be not only possible but profitable.

Manufacture in France is mostly centralized near the source of supply of the raw material. The finished product will stand the heavy transport charges, once the humidity and dross have been wrung out of it, better than the raw material. This calls, of course, for rationalization of method and processes all along the line, cheap electric power on the spot being a *sine qua non.*

## Bureau of Mines Issues Circular Dealing With Non-Metals

During the past year an outstanding feature of the work of the Rare Metals and Non-metals Division of the U. S. Bureau of Mines has been the preparation of information circulars on a number of the rare metals and non-metals. These circulars are being compiled as rapidly as possible, and an effort is made to incorporate the type of information most frequently requested by the Bureau's visitors and correspondents. Within the past six months, circulars have been prepared covering barite and barium products; beryllium and beryl; cesium, rubidium, and lithium; mica; monazite, thorium and cerium; phosphate rock; sillimanite, kyanite, andalusite, dumortierite; selenium and tellurium.

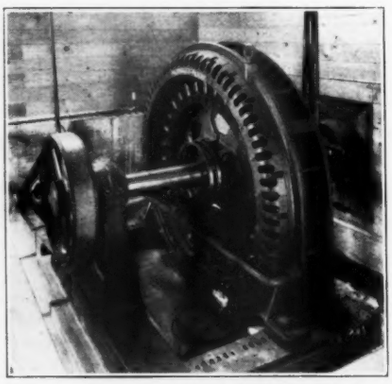
The circulars have been widely reprinted and abstracted, not only in the technical journals of this country but in the foreign journals as well.

# Synchronous Motors Have Been Adapted to Increased Usefulness

By S. M. SNODGRASS
Engineer, Electrical Division, Fairbanks, Morse & Co.

IT has been but a comparatively short time since the application of synchronous motors was limited largely to high-speed drives, where the driven machines were started without load. Later, low-speed, synchronous motors were used for connection through a suitable clutching mechanism to the load. During the last fifteen years, however, improvements have been effected in the starting and operating characteristics, simplicity and reliability of synchronous motors, and the control has been made more simple and flexible. These developments have resulted in broadening the field of application of the synchronous motor until now it is used on many applications in place of the induction motor.

Advantages of synchronous motors at speeds of 600 r.p.m. and above are derived to a great extent from applications requiring one or more of such features as power-factor improvement, highest obtainable efficiencies, absolutely constant speed, or operation for long periods at partial loads. Of these, power-factor correction is the most common of all reasons for installing high-speed, synchronous motors. Generally, squirrel-cage motors, rated at 250 hp. and smaller, at 600 r.p.m. and up, with manually-operated starting compensators, are less expensive than unity-power-factor synchronous motors of the same rating with the necessary direct-current exciters and reduced-voltage manual starters. Because of the difference in price of the high-speed motors within these limits, the squirrel-cage induction motor may be chosen to advantage in most instances where power-factor correction is not required, especially if a squirrel-cage motor of the highest satisfactory speed is selected so that it will operate at rated full load.



Synchronous motor applied to existing compressor, primarily to improve the power factor.

High-speed induction motors operate at comparatively high efficiencies and power-factor when under full load. However, power factors are much lower at low speeds than at high speeds and, likewise, the efficiencies decrease with the speed ratings. Another factor is that the starting torque of a squirrel-cage motor decreases with the speed ratings. These characteristics of low-speed induction motors and the comparable first cost of synchronous motors, in most cases, warrant the use of the latter type for driving direct-connected, low-speed machinery.

The principal advantages of synchronous motors are, in general, for high-speed applications: power-factor correction, higher efficiencies, and constant speed irrespective of load conditions and starting torques comparable with squirrel-cage induction motors.

In low-speed applications the advantages are: power-factor correction, higher efficiencies, and constant speed irrespective of load conditions as in the first group. In addition, these motors are available for practically any commercial application and they are recommended for automatic starting by means of inexpensive, simple, and reliable across-the-line type, full voltage push button starter. They are especially adapted for direct connection to the load; they require minimum floor space; they are comparable in cost with high-speed induction motors and the required speed-reducing drive for application to low-speed machinery. They are subject to lower maintenance expense than a high-speed motor and the required speed-reducing devices, and are less expensive than an induction motor of equal horsepower and speed rating.

Certain inherent characteristics of synchronous motors make possible a most economical and satisfactory design in speeds ranging from 1,800 r.p.m. down to 72 r.p.m. Induction motors, however, below 600 r.p.m. suffer a great handicap in performance because of design limitations and, for this reason, when driving slow-speed machines, high-speed motors are used with mechanical speed-reducing mechanisms such as belts, chains or gears.

Elimination of all forms of mechanical speed-reducers is constantly sought by operating engineers, as the elimination of every possible step in the conversion of power in their plants means the elimination of possible causes of maintenance expense and interference with continuous production.

Power losses in mechanical speed-reducing mechanisms vary from 2 to 15 per cent or more of the total power transmitted. Directly coupled synchronous motors avoid these losses.

Maintenance of high-power factor results in great economies in the generation, transmission and transformation of electric power as compared with operation on a low, lagging power factor. Induction motors always operate at a lagging power factor, which becomes excessive at speeds below 600 r.p.m. and at part load. Synchronous motors always

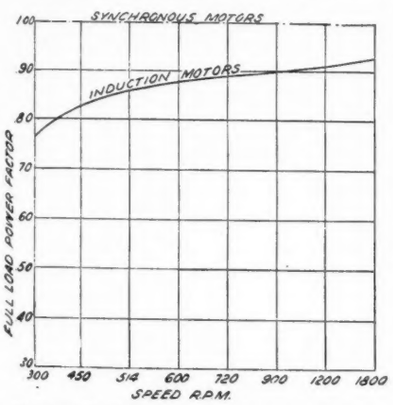
operate at unity power factor, which is the most efficient power factor for the operation of an electrical power system, or at a leading power factor to compensate for the lagging power factor of induction motors on the system.

Thus the installation of synchronous motors always results in raising the power factor. To the user who buys his power this will likely result in a lower power rate as well as a saving in electric power transmission losses in his plant and the maintenance of a more constant voltage.

Users of electrical energy are interested in power-factor correction insofar as it reduces operating costs and provides better service. Increasing the plant power-factor may be beneficial in that it may afford an opportunity to add load to lines and transformers which may be fully loaded, without increasing either line or transformer capacity, or it may effect a reduction in load on overloaded lines and transformers without reducing the connected horsepower load.

Actual current taken from the line by a synchronous motor is either in phase, leading or lagging, depending upon the amount of exciting current supplied to its direct-current field. The power factor may be kept at unity with the current and voltage in phase by proper adjustment of the direct-current field excitation or by overexciting the field, a leading current and power factor may be obtained.

In most commercial applications of synchronous motors, the field current is adjusted for rated load and power factor. If the load decreases under these conditions the motor will operate at a greater leading power factor, giving more than normal power-factor correction.




**Typical full-load power factors of 250-hp. induction and 1.0 power factor synchronous motors at various speeds.**

A unity-power-factor motor of a rating larger than is necessary to drive its mechanical load will have sufficient stator capacity to operate at some leading power factor; however, an oversize unity-power-factor motor should not be used for leading power-factor-operation, because of the limitation in capacity of the direct-current field and the lower efficiencies. Instead, a motor should be used with the required horsepower rating necessary to drive the mechanical load and at a leading power-factor rating to give the required power-factor improvement.

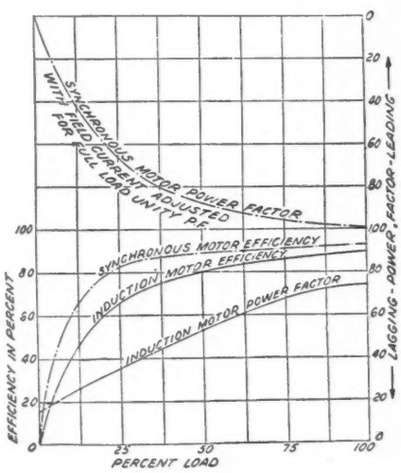
One desirable feature of the synchronous motor is its inherent tendency to stabilize line-voltage. High line-voltage causes a decrease in the leading reactive kva., and low voltage, within certain limits, causes an increase in the leading reactive kva. These characteristics, therefore, assist in holding a constant voltage.

Synchronous motors, in their earliest form, were awkward and difficult to control. These objections have been removed, however, and the modern synchronous motor is a rugged machine that can be installed anywhere in the plant and operated by unskilled attendants, and that will give the same continuous service, low maintenance expense, and long life that can be realized with the best induction motors.

The widespread use of synchronous motors in industry dates from the time these motors were provided with squirrel-cage windings in the pole faces for starting and were thus able to start and accelerate to full speed with at least a part of their full load. Even with the use of a starting winding, early synchronous motors were built from alternator designs to secure manufacturing economies and, as a result, the advantages of a design for best synchronous motor characteristics were not realized.

Torques now available in the modern synchronous motors have been largely responsible for a greatly enlarged market for this type of motor. There are many applications that are now best driven by synchronous motors which were considered totally unsuited a few years ago. The elimination of the need for clutches and the simplification of control made possible by full-voltage starting have done a great deal to popularize the use of synchronous motors.

Closely allied with starting and pull-in torques, in synchronous-motor design, is starting kva. This varies from approximately 200 per cent to 250 per cent for motors for low-speed compressors and similar applications started on full voltage to several times this amount for applications requiring very high starting and pull-in torques.




**Comparative characteristics of 200-hp., 300-r.p.m., 60-cycle synchronous and induction motors.**

Pull-out torque is of importance for loads that vary over a substantial range during normal operation. Full understanding of design factors affecting the pull-out torque of synchronous motors has made possible many successful applications that have heretofore been considered as totally unsuited for this type of motor.

# Produces Sand, Gravel and Gold from Rich Creek Deposit in California

MANY of California's best gravel deposits lie in the beds of small creeks or rivers coming out of the mountains. The beds of these streams are usually made up of sand and gravel that the waters have carried from the mountains, and the streams have the happy faculty of filling new material each year into any holes that have been dug in their beds, so that there is always a plentiful supply of material within the reach of crushing and screening plants established along their banks.

Quite often, too, there is gold mixed with the sand and gravel in the stream beds, especially near the bedrock bottom—not, to be sure, in any fabulous quantities, but enough to make a worth-while sideline for a plant whose main business is to make a commercial product out of the rock through which the particles of gold are scattered.

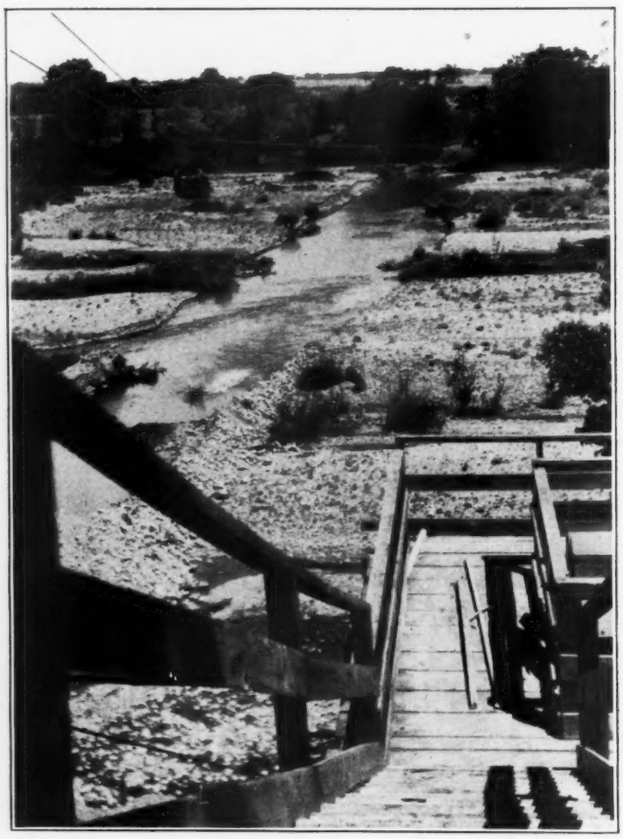
One of the companies making use of such a site is the Johnston Rock Co., of Chico, Cal., which, two years ago, built a large new sand-and-gravel plant along Butte Creek, a few miles from the town of Chico, where the bed of the creek contains large quantities of excellent sand and gravel. Like other operations in the district, this deposit has an occasional "refill," accomplished when the spring floods carry down great quantities of fresh material that is trapped in any holes that have been dug in the stream bed. This refill, in the general experience of the producers in the vicinity, is more desirable than the original deposit because there is not so large a percentage of oversize boulders to handle. In the virgin deposit some of the boulders run up to several feet in diameter.

The deposit at Chico also contains a small amount of gold, and special arrangements have been made to recover it in the plant. The profit from the gold is not large, but it helps to stabilize the business of the plant by offsetting occasional handicaps of high freight rates or a slow market for the gravel.

Sand and gravel are excavated from the river bed and delivered to the top of the screening plant by a Sauerman 1½-cu. yd. slackline cableway, operating over a total span of 1,000 ft. The cableway equipment includes a Sauerman steel mast 125 ft. high, and tension and guide blocks equipped with roller bearings. These features assist in the efficient operation of the cableway by facilitating a high-speed operation over the long span, particularly by speeding up the gravity return of the empty bucket. The power unit is a Sauerman two-speed, electric-motor, cableway hoist.

The first part of the screening process in the plant is much the same as in the usual plant of this kind, but the treatment of the sand is somewhat different because of the arrangement for recovering gold. The material carried to the top of the plant by the Sauerman cableway is discharged over a grizzly to a receiving hopper and then passes to a rotary screen where it is separated into sand, gravel and boulders.

Boulders are chuted to a crusher and the crusher product is conveyed by a bucket elevator to shaker screens, the sized products dropping to a system of concrete storage bins. Gravel is likewise separately elevated, screened, graded and stored. The concrete storage bins empty through gates onto a tunnel belt, on which uniform mixtures of the various sizes, when desired, can be made for shipment. A bucket elevator takes the material from the tunnel belt to cars.



Slackline excavating across channel of Butte Creek.

The mixture of sand and water issuing from the gravel screens contains the by-product gold, and passes first down a flume containing a series of riffles, set at a proper slope to allow the heavier materials to settle into the pockets formed by the cross bars. At intervals the flow of water and sand is diverted to allow a man to scoop out the black sand and gold that have collected in the pockets. The sand and gold are then treated with mercury to form an amalgam with the gold, and this amalgam is sent to a refinery to recover the gold. The sand and water that pass over the riffles pass on to settling tanks where the sand is dewatered and then stored in a unit of the concrete bins.

Most of the product of the plant is shipped out by rail, via a line of the

Southern Pacific Railroad which passes nearby. The products include gravel, crushed gravel, and sand, and also a special oil-treated crushed gravel for surfacing secondary roads, produced at an auxiliary plant on the property.

Besides the deposit of material in the river-bed, the plant also obtains some of its raw material from a big spoil pile left by a gold dredge which was formerly operated near the present location of the Johnston plant. This material is excavated by a power shovel and carried to the plant by a conveyor system.

The Johnston Rock Co. was organized by J. E. Johnston of Stockton, Cal., a prominent general contractor. The plant was designed by the Webster-Brinkley Co. of Oakland, and was built under the supervision of S. M. McGaw, engineer for J. E. Johnston. Clark Hewitt, formerly with the California Division of Highways, is general manager for the company.

## World-wide Benefits of Business Will Follow Road Congress

That the Sixth International Road Congress, to be held in Washington, D. C., Oct. 6 to 11, will exert a beneficial influence upon business, not only in this country but throughout the world, was the opinion expressed by Roy D. Chapin, president of the American Organizing Commission.

"The fact that 60 or more foreign governments have seen fit to send delegations to this Congress," Mr. Chapin said, "indicates, beyond any doubt, that economic conditions throughout the world are on the upgrade. These delegations number anywhere from one to 25 or 30 persons. The caliber of the foreign engineers and highway administrators that will gather in Washington indicates the great amount of interest which countries throughout the world are taking in highway transportation.

"The direct public reaction to the Congress will be the impression that world affairs are getting back to their normal course," Mr. Chapin said. "The sessions will serve to rivet public attention to the question of highway transportation, a question that is of vast economic significance to everyone, and they will thus help to turn the world's thought toward more fruitful channels.

"It is well-known that transportation is one of the most important keys to economic progress and inasmuch as highways are built at comparatively small cost and are built quickly, we can look for an expansion of highway systems all over the world within the comparatively near future.

"The delegates, having had an opportunity to discuss the latest developments in highway transportation from both the engineering and economic standpoints, will return home with substantial reports which will serve as bases for expansion of their countries' highway programs. Public demand and economic necessity will make it paramount that as much of these programs as is possible be undertaken without appreciable delay."

An expansion of highway systems throughout the world naturally means increased employment in construction and, as a logical sequence, increased employment in the systems of distribution and production. While this will not have a direct and immediate effect upon present conditions, with an acceleration in construction in the near future, we may look for a gradual and decided improvement in economic affairs. Continuance of an expanded highway program will assure increased stability to the economic structure of the world.

## More Potash Has Been Found by Two Drill-Holes in New Mexico

The Dept. of the Interior recently announced the results of chemical and mineralogical tests of the cores from the fifteenth and sixteenth potash test-holes drilled by the Bureau of Mines under the act authorizing co-operative investigations for potash by the Dept. of the Interior and the Dept. of Commerce. The fifteenth test-hole was drilled in Eddy County, N. Mex., to a depth of 1,079 ft. 6 in.; the sixteenth was drilled in Chaves County, N. Mex., to a depth of 514 ft. The only potash mineral found in either well was polyhalite, but this mineral occurs in sufficient quantity at several depths to have potential commercial value. Salt beds were encountered at 517 ft. in the fifteenth hole and at 364 ft. in the sixteenth.

## Problems of Industrial Management Are Related to Psychology

The daily sectional meetings that are scheduled during the annual congress of The National Safety Council will not start until 9:30 a. m. This will permit everyone to attend the morning series of instructive lectures by Dr. J. A. Melrose, head of the Department of Psychology and Philosophy at James Milliken University. They start promptly at 8:30 and end promptly at 9:25. Dr. Melrose has been eminently successful in interpreting in non-technical language the value of applied psychology to the problems of industrial management. If you want a better understanding of the human approach to safety, don't miss this series every morning from Tuesday till Friday.

## International Road Builders to Study Engineering Problems

Problems of engineering, administration and financing of highways will be discussed by the foreign delegates to the next convention of the American Road Builders' Assn., as will also various phases of traffic regulation and other matters. Previous sessions were held in Paris in 1908 (at which time the Permanent International Assn. of Road Congresses was founded), in Brussels in 1910, London in 1913, Seville in 1923, and Milan in 1926.

# Effects of Oil, Perforations and Cups on Transmission Belting

By W. F. SCHAPHORST

ALTHOUGH oil does not damage some belts seriously, an excessive amount of oil does cause slipping. As soon as slip occurs there is an unnecessary power loss which is directly proportional to slip. For instance, if the slip amounts to 2 per cent, the power loss is 2 per cent. If the slip is 5 per cent the power loss is 5 per cent. In other words, percentage of power loss is identical with the percentage of slip.

Continued use of a leather belt soaked in mineral oil will develop cracks from fiber abrasion inside. The natural animal oil in high-grade leather protects these fibers against sawing one on the other. Harsh mineral oil removes this film of natural animal lubricant and allows the fibers to contact and develop abrasion. Degreasing will remove the mineral oil and redressing with animal oil will replace the film on each fiber, which means pliability without internal damage.

Excessive slip may also cause burning of the belt. Burning is often more serious than the power loss, cracking, and abrasion combined. It can be very expensive.

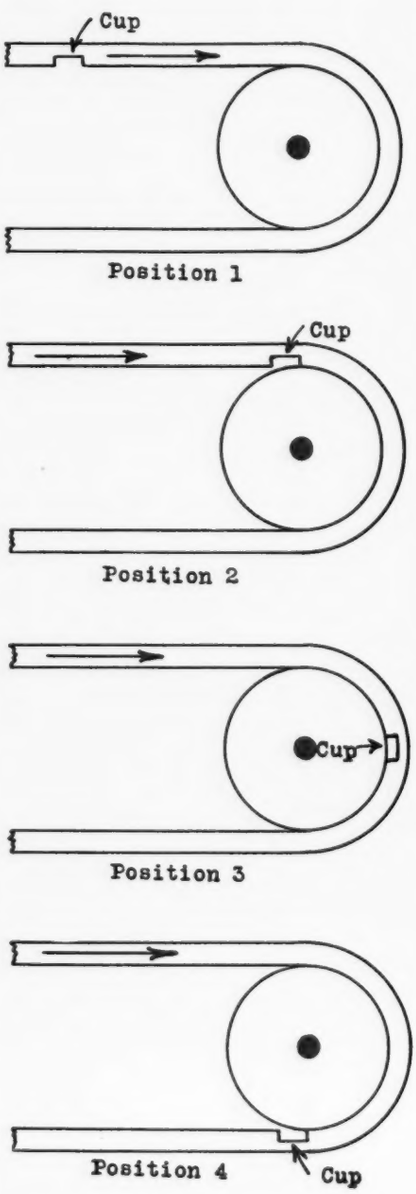
There are two ways in which to tackle this oil-soaked belting problem. First, improve your oil conditions (if possible) so that there will be no leakage or splattering onto the belt. By so doing, it will not be necessary to give the belt a periodic cleaning. Second, use a belt that is as immune as possible to harm from oil and then clean that belt periodically.

Numerous cleaning agents are used for washing leather belts, such as gasoline, naphtha, kerosene, benzol, carbon, tetrachloride, aqua-ammonia, alcohol, and soda and water.

Immerse the loosely wound coil, on edge, in the liquid, and allow to soak over night. Then stand on the other edge for 10 hours. If the belt is dirty in addition to being oil-soaked, the dirt usually loosens and settles to the bottom. The dirt that does not loosen and settle can generally be removed with ease by brushing or scraping. To hasten drying, the belt may be run through an ordinary washing wringer, provided the belt is not too wide. After the belt is dry, lubricate it with a suitable dressing recommended by the manufacturer of the belt.

When using gasoline or naphtha, be extremely careful. According to the U. S. Bureau of Mines, if gasoline be stored in an open receptacle, as in a pail, the room in which the pail is left will soon be filled with an easily explosible mixture. The limits of explosibility are between 1.5 per cent and 6 per cent of gasoline vapor in air. In other words, only a little gasoline vapor is needed to render air explosive —one and one-half cubic feet of gasoline vapor for each 97½ cu. ft. of air. One gallon of gasoline can, when perfectly mixed, render 2,100 cu. ft. of air explosive.

Some types of pulleys also collect oil and become "oil soaked." An oil-soaked belt on oil-soaked pulleys is a poor combination for power transmission. Pulleys can be degreased as well as belts.




Every now and then the cement-mill mechanic hears or reads the claim that a multitude of holes punched through a belt will increase the belt's pulling capacity. Another claim is made that holes cut half-way through will serve as vacuum cups and will increase the belt's capacity.

Neither claim is true. Holes through a belt simply make the belt weaker and thereby reduce its capacity. The contact area is reduced slightly because where there are holes there certainly is no belt contact. Pulling capacity is proportional to the area of belt contact. It is claimed that holes are air escapes, a claim that has never been proved. Most important of all it has been proved that plain solid belts having no holes can outpull belts with holes. So let us dismiss the holes.

Some hole enthusiasts advocate drilling holes through the pulley rims so that solid belts can be used. That method, at least, does not reduce the capacity of the belt, but it is wrong both in theory and practice. Holes are of no assistance.

Let us analyze a belt having holes cut only half-way through. It is claimed by advocates of that type of belt that a vacuum is formed in each and every cup and that the vacuum increases the belt's tractive power. Herewith are four sketches showing a cross-sectional view of a single cup in a belt in four different positions. In position 1 the cup is approaching a pulley. The cup, of course, is full of air for the same reason that a passenger coach running at a velocity of a mile a minute, or faster, contains as much air as when it is standing still. When the cup is in position 2 the action on the air in the cup is one of compression rather than suction. Since holes punched clear through a belt permit air to escape, as is claimed, there would be slight compression of air in the cup, if anything. Then when position 3 is reached, the air will still be in compression, provided we have good contact between the belt and pulley. If contact is poor the slight excess amount of air will escape. But, during the period of escape, that excess air would hold a part of the surface of the belt away from the pulley, causing poor contact. Whatever occurs we can be sure that there is at least as much air in the cup in position 3 as in position 1. Lastly, in position 4, just as the cup leaves the pulley, there can be no suction or vacuum because the cup is still filled with air. Cups, therefore, are of no assistance.

On the other hand, a belt is wrapped around the pulley. There is no appreciable compression, no vacuum, no suction. So, let us also dismiss the vacuum-cup idea. First-class, plain belts containing neither holes nor vacuum cups will pull more, will cost less, will last longer, and will be more satisfactory in every way. A good thing to bear in mind is that freak belts are generally inferior. In fact, anything that is a freak is usually inferior to the time-tried standard product.

# MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

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**J. E. BURKE**
General Manager,
Ready-Mixed Concrete Co.
Pittsburgh, Pa.

# Personal Mention

**Stuart R. Ives,** vice-president and general manager of the Lyle Culvert & Pipe Co., Minneapolis, Minn., has been appointed general manager of the Armco Culvert Manufacturers Assn., with headquarters at Middletown, O.

Mr. Ives comes to his new position with a background of many years of intimate contact with the culvert industry and with the problems of the road builder, the public official and the engineer in charge of drainage work.

**T. A. Burns,** who has had wide experience in selling the larger sizes of excavators, has joined the sales organization of Harnischfeger Corp. He will work directly out of the general sales department in the home office at Milwaukee, Wis.

**Herbert Goodwin,** safety engineer for The Industrial Commission of Ohio at Columbus, who has done some excellent work for the benefit of the ceramic industry in cooperation with the Ohio Ceramic Industries Assn., spent an enjoyable vacation in Mexico at which time he took the opportunity of visiting the pottery plant of his friend Adolfo Gorz known as Fabrica de Loza "El Anfora" S. W. at Mexico City.

**W. J. Coles,** director of the Engineering and Cement Machinery Dept., of Edgar Allen & Co., Ltd., Sheffield, will leave England Sept. 10 on the *Majestic* for a two-months' visit to the U. S. and Canada for the purpose of studying American engineering methods and cement and lime practice. Mr. Coles will arrive about Sept. 16 and his address will be the Edgar Allen Steel Co., 741 Washington St., New York, N. Y.

**J. T. MacKenzie,** chief chemist of the American Cast Iron Pipe Co., has received the honorary degree of Doctor of Science from the University of the South.

**John S. Haggerty,** proprietor of one of the largest common brick manufacturing plants in Detroit, Mich., is listed among the directors of the newly formed American State Trust Co., which opened for business in Detroit recently. The trust company is an outgrowth of the American State Bank, of which Mr. Haggerty is also a director.

**James Pettit,** plant manager of the Pacific Coast Cement Co., of Seattle, Wash., suffered a severe accident, August 26, which crushed his skull. No exact information as to how the accident occurred can be obtained by the company or its employees. He was found unconscious beside the tracks at the plant siding and is at Providence Hospital, Seattle.

**P. J. Freeman,** chief engineer, Bureau of Tests and Specifications, Department of Public Works, Allegheny County, Pittsburgh, Pa., has been elected chairman of Committee D-4 on Road and Paving Materials of the American Society for Testing Materials.

**George M. Norman,** technical director of the Hercules Powder Co., and **A. B. Nixon,** general manager, Cellulose Products Dept., are enroute to Europe where Mr. Norman will attend the International Cellulose Conference at Liege, Belgium, and Mr. Nixon will survey the market for American collodion cotton in Germany and other countries.

**H. F. Moore,** professor of engineering materials, University of Illinois, Urbana, Ill., has been reappointed a member of the American Society for Testing Materials, Committee E-9 on Correlation of Research for the term of five years. Professor Moore has served as chairman of the committee since its organization. His knowledge and experience in research will be of inestimable service to the committee.

**A. T. Goldbeck,** director, Bureau of Engineering, National Crushed Stone Assn., Washington, D. C., has been elected vice-chairman of Committee D-4 on Road and Paving Materials, of the American Society for Testing Materials.

**William S. Earhardt,** former superintendent of the Penn Shale Brick Co., New Hope, Pa., who has been superintending the construction of a new plant for the Kinney interests at South River, N. J., has been made general superintendent of both plants. **Bernard Carlen,** who has been a foreman on the South River construction work, has been made superintendent of the New Hope plant.

**E. E. Thum** has resigned as associate editor of the *Iron Age* to become editor of the new journal, *Metal Progress,* to be published by the American Society for Steel Treating.

**L. H. Fry,** for many years with the Standard Steel Works Co., has recently become associated with the Edgewater Steel Co. as Railway Engineer.

**E. H. Grafton** is manager of the Chemical Development Division of the American Salpa Corp., Spotswood, N. J.

**W. H. Bassett, Jr.,** is technical superintendent of the Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y.

**H. L. Howe,** director of design and construction, City of Rochester, Department of Public Works, Bureau of Design and Construction, Rochester, N. Y., has been elected vice-chairman of Committee D-4 on Road and Paving Materials of the American Society for Testing Materials.

**E. E. Eakins,** vice-chairman of Committee C-7, American Society for Testing Materials, is connected with the Oyster Shell Products Corp.

**R. W. Smith,** for several years in the sales department of the Thew Shovel Co., Lorain, O., has been appointed assistant advertising manager.

**O. E. Harder** has left the School of Mines and Metallurgy, University of Minnesota, to become assistant director of the Battelle Memorial Institute, Columbus, O.

**S. C. Hollister,** consulting engineer, Swarthmore, Pa., has been elected chairman of Committee C-2 on Reinforced Concrete of the American Society for Testing Materials.

**Delmer L. Cottle** has been appointed assistant professor of chemistry at Rutgers University. Dr. Cottle received his training at Marietta College, Ohio, and Ohio State.

**M. L. Hartmann** is vice-president of the Dicalite Co., Los Angeles.

## Obituary

**Dr. Gordon Richardson,** head of the research department of the Maywood Chemical Co., at Maywood, N. J., died on Aug. 5 at a hospital in Hackensack, N. J. He was 72 years of age, and had been a professor of chemistry at Oxford University, and at McGill University, in Montreal. For the last few years Dr. Richardson had been doing research work on beryllium. He is survived by his widow and one son.

**Donald B. Hall,** who, for the past three years, has been employed by the Structural Clay Tile Assn. as research engineer, at the Roseville plant, Ohio State University, died in the Zanesville Hospital of pneumonia on August 3.

Mr. Hall's particular contribution was the development of machinery for the production of light-weight structural material.

**Otto E. Tisch,** manager of the Geo. Scofield division of the Pioneer Sand & Gravel Co., of Seattle, Wash., died recently following an attack of pneumonia. Mr. Tisch was 58 years of age and is survived by his widow and one son.

# Coming Events

**Sept. 14-20, 1930, Springfield, Mass.** Fourteenth annual Eastern States Exposition. Industrial Arts Exhibition in connection.

**Sept. 16, 1930, San Francisco, Cal.** Portland Cement Association regional safety meeting, at St. Francis Hotel. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

**Sept. 18-19, 1930, Chicago, Ill.** Annual meeting, Manufacturers' Division, National Sand and Gravel Assn. at Stevens Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

**Sept. 23, 1930, Ogden, Utah.** Portland Cement Association regional safety meeting. Hotel Bigelow. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

**Sept. 29-Oct. 3, 1930, Pittsburgh, Pa.** Annual congress and exposition. National Safety Council, William Penn Hotel. W. H. Cameron, managing director, 20 N. Wacker Drive, Chicago.

**October 6-10, 1930, Washington, D. C.** Sixth International Road Congress at invitation of the United States Government. Thos. H. McDonald, chief of the United States Bureau of Public Roads, secretary-general of the American Organizing Commission. International Road Exposition in charge of the American Road Builders' Association. Charles M. Upham, engineer - director, National Press Bldg., Washington, D. C.

**Nov. 17-19, 1930, Chicago, Ill.** Annual meeting, Portland Cement Association, at Blackstone Hotel. Wm. M. Kinney, secretary, 33 W. Grand Ave., Chicago, Ill. (Open to Association members only.)

**Dec. 1-5, 1930, Memphis, Tenn.** Ninth Annual Asphalt Paving Conference of the Asphalt Institute. Meeting of the Association of Asphalt Paving Technologists in conjunction.

**Dec. 1-6, 1930, New York, N. Y.** Ninth National Exposition of Power and Mechanical Engineering, to be held at Grand Central Palace. I. E. Moultrop, chairman.

**Jan. 19-22, 1931, St. Louis, Mo.** Annual Convention National Crushed Stone Assn., Hotel Jefferson. J. R. Boyd, secretary, 1735 14th St., N. W., Washington, D. C.

**Jan. 27-29, 1931, St. Louis, Mo.** Annual convention National Sand & Gravel Assn., Hotel Jefferson. V. P. Ahearn, executive secretary, Washington, D. C.

**Feb. 10-13, 1931, Chicago, Ill.** Fifth Midwest Power Engineering Conference. G. E. Pfisterer, secretary, 308 W. Washington St., Chicago.

**Feb. 24-27, 1931, Wichita, Kan.** Sixth Annual Southwest Road Show and School, Exposition Building. F. G. Wieland, manager, P. O. Box 1043, Wichita, Kan.

**July 17-Aug. 28, 1931, Atlantic City, N. J.** American Fair, featuring road building, at Auditorium. P. F. Seward, American Road Builders' Assn., Washington, D. C.

## Sand-and-Gravel Industry Is Big Railroad Customer

The official reports of the Interstate Commerce Commission covering revenue freight statistics for 1928 and 1929 afford ample proof that the sand-and-gravel industry constitutes one of the most important customers of the railroads of the country. These products rank fourth among all commodities from the standpoint of volume, being exceeded only by bituminous coal, anthracite coal, and iron ore. As a revenue producer to the railroads, sand-and-gravel stands ninth among all commodities carried. The average loading per car of sand-and-gravel in 1929 was 53.87 tons compared with 52.74 tons in 1928.

## Simple Concrete Plant Served Construction Job

During the pouring of concrete on the River des Péres construction job at St. Louis, Mo., the Callahan Construction Co., of Waco, Tex., installed a temporary plant for receiving aggregates by railroad and preparing the concrete in a central mixer.

A General Conveyor & Mfg. Co. 20-in. conveyor received the sand and gravel as they were discharged from bottom-dump cars into a track-hopper and elevated them a few feet to the foot of another conveyor of the same make and width which, in turn, elevated them to a Blaw-Knox steel bin below, which was mounted on a T. L. Smith Co. mixer. The track-hopper was furnished by the General Conveyor company.

The installation was simple, inexpensive, required little supervision or maintenance, and handled 80 to 100 tons of material per hour.

## Atlas Trophy Dedicated in Entirely New Manner

The Universal Atlas Cement Co., of Duluth, Minn., adopted a novel method of celebrating the dedication of the safety trophy won by this plant. Thirty-two boy scouts, each scout representing one month of the mill's consecutive no-accident record, came on the field formed to represent the word SAFETY and they brought with them 955 gas-filled balloons. At a signal all 955 balloons were released simultaneously and sailed into the blue.

Each of these gaily colored spheres represented one consecutive no-accident day, and each carried a tag bearing a brief safety message, a "Safety Crusader" badge of the National Safety Council, and a reproduction of a safety poster.

Prizes were offered to the finders of balloons traveling furthest from the Duluth plant and each tag carried the name of an employee. Prizes were awarded to the employees whose balloons traveled the furthest.

A picnic luncheon and athletic events followed the dedication.

## Canadian Quarry Profits Using Vibrating Screen

The separation of its crushed limestone into clean, marketable grades enables the La Cie Carriére Giffard, Ltd., of Giffard, Quebec, to realize considerably higher prices than it did prior to the installation of its Link-Belt vibrating screens. In the case of limestone grit, the company now markets 35 per cent of this grade for from

Vibrating screen.

two to three times the price formerly obtained for the unscreened grit.

The vibrating screens have replaced revolving screens, and the quarry manager points to three main benefits that have accrued as a result of the change: substantial saving of power, lower maintenance expense, and less space required.

The president of this company states that the screens are performing splendidly. Any screen-cloth is good for the screening of approximately 25,000 tons.

## Amtorg Trading Co. Buys Westinghouse Equipment

Six 250-hp. CW wound-rotor induction motors for driving pulverizing equipment have been ordered from the Westinghouse Electric & Manufacturing Co. by the Amtorg Trading Co. These motors are for 6,300 v., 3-ph., 50-cy. operation, and each has 14 poles. They are equipped with bedplates for coupled drive.

The order also includes six controllers for these motors. Magnetic control will be used for the primaries, and manual-drum type of control will be used for the secondaries.

# Financial News

*The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of* PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

## Raybestos' Six Months' Net Income is $825,499

Raybestos-Manhattan, Inc., reports for the six months ended June 30, 1930, a consolidated net income of $825,499, after charges, depreciation and federal taxes, equivalent to $1.22 per share on 675,007 no-par shares of common stock. This compares with $2,098,530, or $3.10 a share, in the first half of 1929.

The consolidated net income for the quarter ended June 30, amounted to $374,524, after the above charges, equal to 55 cents a share, comparing with $450,975, or 67 cents per share in the preceding quarter.

The income account for six months ended June 30, 1930, compares as follows:

| | 1930 | 1929 | 1928 |
|---|---|---|---|
| Net Sales | $9,571,451 | $12,785,382 | $11,120,710 |
| Net before depreciation* | 1,098,854 | 2,411,249 | 1,589,911 |
| Depreciation | 273,355 | 312,719 | 287,150 |
| Net income | $825,499 | $2,098,530 | $1,302,761 |

* After federal taxes and adjustment of inventories.

Current assets of Raybestos-Manhattan, Inc., as of June 30, 1930, were $9,955,082, and current liabilities were $1,056,415, a ratio of more than 9 to 1. Cash funds, including readily marketable securities, were $3,215,177 and were more than three times the current liabilities. Total assets were $19,490,922 and there were no bank loans or funded debt. The surplus of the company at June 30, last, was $8,099,873. Each operating division of the company showed a profit.

The company declared the regular quarterly dividend of 65 cents per share on the common stock, payable Sept. 15, 1930.

International Salt Co. declared an initial dividend of 75 cents on the new common stock, payable Oct. 1, to stock of record Sept. 15. Three months ago, a dividend of $2 on the old common was declared, against $1.50 previously. In June, the company split the stock three for one and offered an additional new share at $36 for each three shares of new stock held. For the six months ended June 30, the company reported a profit of $322,-901, after charges and bond-sinking fund, but before federal taxes; comparing with $231,298 in the first half of 1929.

Rights for the new stock were fully subscribed for, as of their expiration date on July 21, 1930, giving the company 240,000 shares of common outstanding stock.

Payment of 75 cents on the new common stock can be construed as a quarterly dividend, placing the stock on a $3 annual basis.

After the meeting, Mortimer B. Fuller, president, stated that the outlook for the balance of the year is satisfactory and that the condition of the company has never been better.

## Asbestos Bondholders Favor Delayed Interest

Holders of $2,885,700 of a total outstanding issue of $4,239,000 general mortgage 30-year 6 per cent sinking-fund bonds of Asbestos Corp., Ltd., maturing Jan. 1, 1956, approved the resolution authorizing postponement of payment of interest and yearly installment of sinking fund on the bonds.

The resolution, which also had been approved by the bondholders' committee, provided that, within fifteen days, the company arrange appointment of one of two directors to represent the bondholders; engage the New York firm of Stewart, James & Cook to investigate the mining properties of the company; make a report, and pay interest, at the rate of 8 per cent per year on the bonds, payment of which might be postponed. The time for the payment of the half-yearly interest installment, due July 1, 1930, was to be postponed to Jan. 1, 1931, with a further proviso that further postponement of interest might be made to Jan. 1, 1932, if the bondholders' committee approved; and the interest payment due Jan. 1, 1931, might be postponed also for a year.

Frank B. Common, chairman of the meeting, stated that, due to the unfavorable market for the company's product, low prices and similar difficulties, business during the summer had not been up to earlier expectations of the management. He announced that it would be necessary to consider steps looking toward reorganization of certain parts of the capital structure.

Col. R. F. Massie, president, explained that the year's budget was drawn up on the basis of estimated sales and shipments called for by good contracts. Due to unfavorable business conditions in the United States, Europe and Japan, the company's chief markets, shipping instructions had been held up, which made necessary new plans by the company.

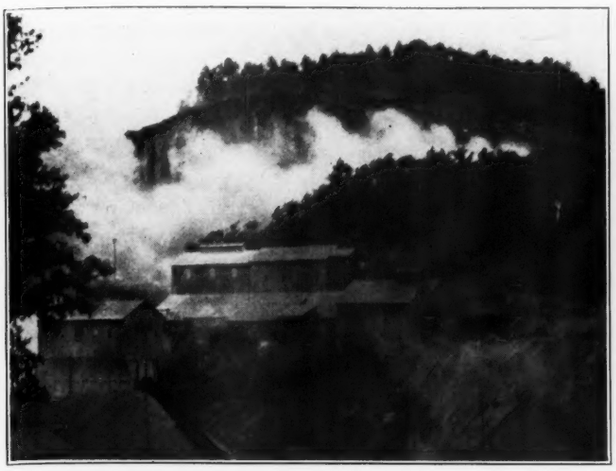
## International Salt's New Common is on $3 Basis

The directors of the International Salt Co. met on August 20th for action on the initial dividend on the new no-par common stock. In all likelihood the stock will be placed on an annual basis of at least $3. For the six months ended June 30th the company reported net profit of $322,901 after charges and bond sinking fund but before federal taxes against $231,-298 in the first half of 1929.

### CURRENT DIVIDENDS

| Company | Class of Stock | Dividend Rate | Holders of Record | Payable | Company | Class of Stock | Dividend Rate | Holders of Record | Payable |
|---|---|---|---|---|---|---|---|---|---|
| Alpha Portland Cement | Preferred | 1¾% qr. | Sept. 1 | Sept. 15 | Metropolitan Paving Brick | Preferred | $1.75 qr. | Sept. 15 | Oct. 1 |
| Canada Cement | Preferred | 1⅝% qr. | Aug. 28 | Sept. 30 | Metropolitan Paving Brick | Common | $0.50 qr. | Aug. 15 | Sept. 1 |
| Canada Paving and Supply | 1st Pfd. | 1¾% qr. | Aug. 15 | Sept. 1 | National Brick of La Prairie | Preferred | $0.75 qr. | Aug. 31 | Sept. 15 |
| Cleveland Stove Quarries | Common | $0.75 qr. | Aug. 15 | Sept. 1 | Newago Portland Cement | Preferred | $1.75 qr. | Sept. 26 | Sept. 30 |
| Cleveland Stove Quarries | Common | $0.25 extra | Aug. 15 | Sept. 1 | New York Trap Rock | Preferred | $1.75 qr. | Sept. 20 | Oct. 1 |
| Cleveland Builders Supply | Common | $0.50 qr. | Sept. 15 | Oct. 1 | Peerless Cement | Preferred | $1.75 qr. | Sept. 20 | Sept. 30 |
| Consumers Co | Pr. Pfd. | $1.50 qr. | Sept. 15 | Oct. 1 | Raybestos Manhattan | Common | $0.65 qr. | Sept. 2 | Sept. 15 |
| General Asphalt | Common | $1.00 qr. | Aug. 28 | Sept. 15 | Superior Portland Cement | Class A | $0.27½ | Sept. 23 | Oct. 1 |
| Indiana Limestone | Preferred | 1¾% qr. | Aug. 20 | Sept. 1 | Texas Gulf Sulphur | | $1.00 qr. | Sept. 3 | Sept. 15 |
| International Cement | Common | $1.00 qr. | Sept. 11 | Sept. 30 | United States Gypsum | Preferred | $1.75 qr. | Sept. 15 | Sept. 30 |
| International Salt | Com. (new) | $0.75 qr. | Sept. 15 | Oct. 1 | United States Gypsum | Common | $0.40 qr. | Sept. 15 | Sept. 30 |
| Johns Manville | Preferred | $1.75 qr. | Sept. 11 | Oct. 1 | Virginia Carolina Chemical | Pr. Pfd. | 1¾% qr. | Aug. 17 | Sept. 1 |
| Johns Manville | Common | $0.75 qr. | Sept. 25 | Oct. 15 | Warner Co | 1st Pfd. | $1.75 qr. | Sept. 15 | Oct. 1 |
| Kentucky Rock Asphalt | Preferred | 1¾% qr. | Aug. 15 | Sept. 3 | Warner Co | 2nd Pfd. | $1.75 qr. | Sept. 15 | Oct. 1 |
| Lawrence Portland Cement | | 1% qr | Aug. 31 | Sept. 15 | Warner Co | Common | $0.50 qr. | Sept. 30 | Oct. 15 |
| Material Service Corp | | $0.50 qr. | Aug. 15 | Sept. 1 | Warner Co | Common | $0.25 extra | Sept. 30 | Oct. 15 |

# Single Blast Provides Quarry With Year's Rock Supply



Looking past the plant buildings toward quarry immediately after the blast.

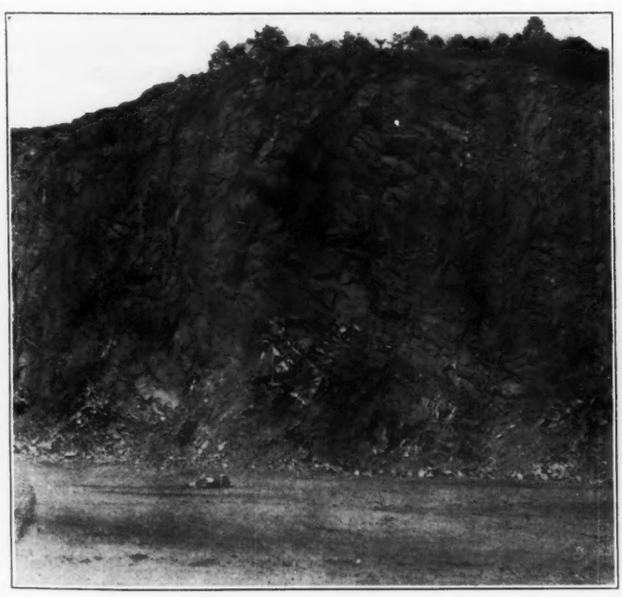
Floor of quarry, preceding the blast, the plant, and storage piles.

A charge of 51,400 lb. of dynamite was successfully fired at the Clingan trap-rock quarry of the John T. Dyer Co., near Birdsboro, Pa., on August 22. This charge comprised 6,000 lb. of 90-per cent dynamite, 6,000 lb. of 75-per cent dynamite, 18,450 lb. of 60-per cent dynamite, 10,000 lb. of Gelex, and 10,950 lb. of Extra A. It made approximately 275,000 tons of rock available in such shape that, in less than two hours after the blast, the steam shovel was back again in the quarry loading the new stone into carts for its trip to the crushers.

Levi F. Carson, superintendent, said it was the best shot made since the quarry was opened nineteen years ago and that it provided a year's supply for him. Harry Schwartz, superintendent of the original Dyer quarry not far from Clingan, where he has been getting out stone for the past 36 years, remarked, as he was looking at the result of the blast, that it was the cleanest and prettiest shot he ever saw, as it worked so nicely from the bottom.

The charge was placed in 19 holes, which varied in depth from 186 ft. to 219 ft., with an average of 200 ft. These had been drilled 20 ft. apart and 30 ft. back from the face of the quarry. The entire shot was plotted

Left to right (front): E. T. Wolf; H. H. Eshleman, asst. supt.; Levi F. Carson, supt.; Nick Phillips, foreman; Hall Weaver. (Rear): A. J. Earp; H. Siebert; Jos. Falconi, head blaster; J. W. Koster; G. Banken; Al Petze; Howard E. Deeds and Frank Good, drillers; Eli Lebo, dynamite truck driver.



Face and floor of Clingan quarry before the blast.

Portion of quarry face after blasting 19 holes.

ahead of time by Supt. Carson and E. T. Wolf, DuPont company salesman.

For nine months, two 30B Armstrong gasoline well drillers had been sinking these holes with 6-in. bits. The two crews were in charge of Howard E. Deeds and Frank Good. Immediately before the holes were loaded all the water was taken out of them with the ordinary well-drill bailer. This practice makes certain that the full strength of the blast is applied to the rock.

Preparing primers for secondary shooting.

Two crews of six men each started loading holes at ten o'clock, the day of the blast and, at six o'clock the same day, everything was ready for the final connections. This task of placing 25½ tons of dynamite was speeded considerably by knowing beforehand the exact load for each hole.

The different kinds of DuPont material required were sorted at the quarry storage house and a truck was loaded for its three-quarter-mile trip to the top of the cliff with a mixed load. In this way each hole, just in back of it in boxes, had the full charge and there was no confusion nor mistake made in loading the nineteen holes.

The practice at this quarry is to make a primer of the first cartridge by lowering it to the bottom of the hole with the cord attached. Then the rest of the load, right at hand, is dropped into it. Gelatine sticks 5 in. by 24 in. and weighing 25 lb. each were used. Some holes had no break in them while others had two and three.

A number of the holes had a 45-ft. toe and were loaded with a certain proportion of 90-per cent dynamite. Generous amounts of 75-per cent and 60-per cent strength were used where hard beds of rock warranted them, although Gelex and Extra A were used in the largest amounts. From 10 ft. to 20 ft. of stone-dust was used to tamp each hole.

Cordeau-Bickford fuse, 4,500 feet of it, with an electric cap at each end and a No. 3 hand-blasting machine, were used to fire the charge. From the spectators' viewpoint on top of the storage piles across the creek and about 2,000 feet on an airline from the blast, there was practically no visual evidence of an explosion. Three minutes after the whistle blew, at 11:30, there was a muffled rumble, a young mountain-side crumbled in the distance and the pile of crushed stone shook like a bowl of jelly.

Within fifteen minutes after the blast, a crew was busy preparing for the secondary shots needed to move some of the large pieces which had rolled out into the front and, when the afternoon's operations began, the chance visitor would never have known that the event prepared for nearly a year had taken place.

This quarry was opened in 1911 by simply getting the rock from a ledge at the side of a public road. The same bed is worked today although the face is now over 200 ft. high. All stone is moved from it on a level to the crushers on the other side of the road where there is a sharp drop to the creek and railroad siding.

Because of this ideal location, it is operated on a very economical basis. Horses move practically all of the stone to the crushers and then electricity takes care of it until it leaves on cars. Practically no stone is hauled away by trucks, although they are used extensively when storage operations are going on, as at present.

Twelve one-horse carts grouped around a Marion steam shovel to haul the stone away may seem a bit old-fashioned to a modern efficiency engineer, but they certainly are easy on the expense sheet of the Dyer quarry, where it is customary to get out from 1,000 to 1,600 tons of stone per day.

The carts average one ton to a load. The horses drive themselves be-

Loading rock into 1-hp. "truck."

tween the shovel and the crushers, only four men being needed to handle the twelve horses. One man keeps them in line at the shovel, one holds each horse while the load is dropping into the cart, and two men at the crushers back the carts and dump the contents. These horses are not slow-moving old plugs but slick, peppy beasts that are kept in the best of condition. One of them, Old Barney, has been doing this work for 18 years and appears good for several more years of it.

Practically no expense, in the normal operation of this quarry, is incurred for lifting stone after it is once in the horse-cart. The crushers, screens and storage bins are so arranged that the stone moves downhill all the time until it is in the cars. The company has its own steam locomotive and crew for moving cars to and from the main line, approximately one mile away.

Numerous stone sizes are made at this plant, including screenings, ¼-in., ½-in., ¾-in., 1-in., 1¼-in., 1½-in., and ballast. Three large Farrell-Bacon crushers are used—one 42-in. and two 36-in.—while a Symons crusher is used for the tailings. Everything moves by electric motors which vary in size from the one 300-hp. which runs two small crushers and two conveyors, to the ½-hp. units in the blacksmith shop.

## Memphis Company Buys Raleigh, Tenn., Plant

J. L. Powell, president of the Powell Lime & Cement Co., Memphis, Tenn., announces the purchase by his company of the Raleigh Sand & Gravel Co., of Raleigh, Tenn. It is intended, Mr. Powell states, to completely rebuild before attempting to operate the new property. The reconstruction program will require from 60 to 90 days and, on completion, the Powell company will produce sand and gravel products which, heretofore, it has purchased from outside sources.

## Crushed Stone Company Obtains New Contracts

The Georgia-Quincey Granite Co., of Sparta, Ga., is supplying crushed stone and other products under contract which will keep the plant busy during the summer and autumn season. C. T. Bailey, superintendent of the plant, states that other important contracts are in view which, if obtained, will keep the plant working to capacity throughout the winter and well into the spring of next year.

## Cement Plant Resumes Operations After Slide

The Beaver Portland Cement Co., of Gold Hill, Ore., resumed operations recently after a protracted idleness of nearly three months, due to a landslide which covered the limestone deposit. During the time required to remove the debris no time was lost as the annual repairs, usually made during the holidays, were completed. Heavy shipments were made during the closed period from the reserve stocks on hand.

# Traffic News and Comment

## Further Discussion of the Proposed Class Rates

In the August issue of PIT AND QUARRY, attention was called to the decision of the Interstate Commerce Commission prescribing a new set-up in connection with class rates.

As pointed out at that time, it is hoped that it will be a long time before the rates on low-valued, heavy-loading articles are made with relation to the class-rate scales.

There are many serious objections to placing such articles as sand, gravel and stone on a classification basis or on a basis related to the first-class rate.

In prescribing a first-class distance scale, consideration must be given first to the terminal and handling charges at the points of origin and destination. Second, consideration must be given to the road-haul cost intervening between the origin and destination. Costs for the various services are ascertained and, when added together, form what is assumed to be the cost to the carrier of transporting the freight. Inasmuch as the first-class rate is to serve as a guide or basis on all class traffic, consideration must be given to the cost of handling less than carload shipments, inasmuch as practically all less-than-carload freight moves on class rates. Consideration must be given to the average weight of cars loaded. For example, in the Western territory the so-called merchandise or package cars are loaded to the extent of only 9,000 or 10,000 lb. From this it will be seen that the terminal charges as well as the road-haul charges are comparatively light on this class of traffic while the expenses are considerable. This naturally raises the question whether it is possible to use a uniform formula in making rates on class-rate traffic as well as rates on commodities loading as heavy as 40 to 50 tons per car.

Many complaints are filed with the Interstate Commerce Commission attacking not only the unreasonableness of prevailing rates but also alleging that rates are prejudicial to the particular camplainant and preferential to competing producers, in violation of Section 3 of the Interstate Commerce Act. It is not a difficult matter for the Interstate Commerce Commission to pass on the unreasonableness of the rates under attack, but when it comes to deciding the prejudicial and preferential features, the case becomes complicated. The Commission must, of course, follow the law which states that all rates which are unduly prejudicial and unduly preferential are unlawful. In such instances, the Commission must decide whether the law is being violated and, if affirmative finding is made, the violation must be removed.

Perhaps the simplest way to remove such violations would be to establish distance rates under which the shipments of all competing producers would move on an equal basis. In other words, each producer would pay the same as his competitor, mile-for-mile. If such an idea is carried to its logical conclusion, we would have a strict mileage scale of rates, totally ignoring competition. Experience has shown that hard-and-fast mileage scales have a tendency to reduce Section 3 complaints, that is, complaints alleging that the complainant is prejudiced and his competitor is preferred.

If, however, mileage scales on low-grade commodities were to be repeatedly attacked as unreasonable, is it not possible that the reasonableness of the mileage scales would be ascertained by a comparison with the class scales?

Let us carry this a little farther. In some territories, rates on certain low-grade articles are made 50 per cent of sixth-class rates. Now, under the new decision of the Interstate Commerce Commission, the sixth-class rate will become 27½ per cent of the first-class rate; and a scale made 50 per cent of sixth-class rate would be approximately 14 per cent of the first-class rate. We would then find that the rates under this particular adjustment, if revised to date, would be on column 14 basis or 14 per cent of the new first-class rate. This means that the new commodity rates would be made in relation to the first-class rate.

As said before, operators hope that the rates on sand, gravel, stone and other low-valued commodities will never be made in relation to the existing first-class rate. On the other hand, the interest of the producers as well as the carriers could best be served by a rate basis that takes into consideration all rate-making factors, including the matter of competition.

Producers should give these possibilities some thought when filing rate complaints with the Interstate Commerce Commission.

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## Ohio Producers Seek Lower Lime Freight

Shipping interests have requested the Central Freight Assn. carriers to revise the existing rates on lime, agricultural, having no commercial value for chemical or building purposes, from Gibsonburg and Woodville, O., to various destinations in Ohio.

Some of the rates proposed by the shipping interests as outlined in Central Freight Assn. dockets 25,918 to 25,921 inclusive, are as follows:

| To | Cents |
|---|---|
| New Waterford, O. | 11 |
| Shadyside, O. | 12½ |
| Powhatan, O. | 12½ |
| Weavers, O. | 11 |
| McMoran, O. | 10 |
| Slater, O. | 10 |
| Wapakoneta, O. | 10½ |
| St. Marys, O. | 10½ |
| Melbern, O. | 11 |
| Forest Hill, O. | 8 |
| Glen Run, O. | 12½ |

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## Lower Rate Asked for S. D. Crushed Stone

Western Trunk Line docket 4264-D relates to an application filed by a shipper for reduction in rates from Dell Rapids and Sioux Falls, S. D., to various destinations in Minnesota.

The present rates as well as the rates sought by the shipper to some of the destinations are shown below:

| | From Dell Rapids, S. D. | | From Sioux Falls, S. D. | |
|---|---|---|---|---|
| To | Present | Proposed | Present | Proposed |
| Pipestone, Minn. | $1.10 | $0.70 | $1.40 | $0.70 |
| Ortonville, Minn. | 2.00 | 1.80 | 2.00 | 1.80 |
| Granite Falls, Minn. | 3.10 | 2.00 | 3.10 | 2.00 |
| Olivia, Minn. | 3.10 | 2.10 | 3.10 | 2.10 |

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## Seek Lower Feldspar Rate Across State of Illinois

The Central Freight Assn. lines have been asked to reduce the present rates on feldspar from E. St. Louis and other Mississippi River crossings to destinations east of the Illinois-Indiana state line, on traffic originating in Wyoming and Colorado.

The following proposed rates illustrate the basis sought by the shippers:

| To | Present | Proposed |
|---|---|---|
| Akron, O. | 26c | 20½c |
| Barberton, O. | 26½c | 20½c |
| Beaver Falls, Pa. | 31c | 24c |
| Bessemer, Pa. | 31c | 24c |
| Buffalo, N. Y. | 31c | 24c |
| Cambridge, O. | 26c | 20½c |
| Cincinnati, O. | 21½c | 17c |
| Columbus, O. | 24c | 18½c |
| Clarksburg, W. Va. | 33c | 26c |
| Detroit, Mich. | 25c | 19½c |
| E. Liverpool, O. | 31c | 24c |
| Evansville, Ind. | 16½c | 13c |
| Findlay, O. | 23½c | 18c |
| Flint, Mich. | 26c | 20½c |
| Grafton, W. Va. | 33c | 26c |
| Greenville, O. | 21½c | 17c |
| Indianapolis, Ind. | 19½c | 15c |
| Kalamazoo, Mich. | 23c | 18c |
| Kokomo, Ind. | 20c | 15½c |
| Kenova, W. Va. | 25c | 19½c |
| Louisville, Ky. | 20c | 15½c |
| McKees Rocks, Pa. | 31c | 24c |
| Muskegon, Mich. | 25c | 19½c |
| Muncie, Ind. | 20½c | 16c |
| New Castle, Pa. | 27½c | 21½c |
| Parkersburg, W. Va. | 26c | 20½c |
| Pittsburgh, Pa. | 31c | 24c |
| Steubenville, O. | 31c | 24c |
| Terre Haute, Ind. | 16½c | 13c |
| Toledo, O. | 24c | 18½c |
| Wheeling, W. Va. | 31c | 24c |
| Vincennes, Ind. | 16½c | 13c |

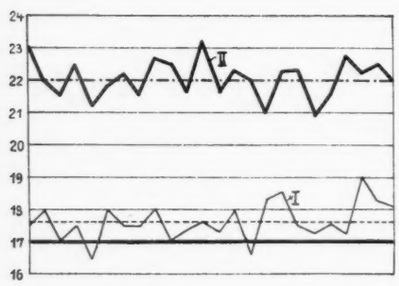
This matter is covered by Central Freight Assn. docket 25,976.

# Review of Foreign Practice

## Test Grinding Elements in Ball-and-Tube Mills

Since the introduction of grinding mills that obtain their grinding action from an internal charge of balls and the like, and particularly since the ball-mill and the tube-mill were combined in the compartment mill, many different forms of grinding media have been employed. It is known that the capacity of the mill and the fineness of the product are directly dependent on the surface action of the grinding media, and it has been determined that the best surface action is obtained with a combination of balls and cubes. Working from these premises the authors of this article made an investigation in a three-compartment mill to try to increase the capacity and fineness through the use of such a charge.

The mill was first filled according to its manufacturers' recommendations with cylindrical media known as Cylpebs. This gave the guaranteed capacity, but as this was not sufficient for the plant's needs, the mill was filled with patented Kordt & Rosch media—the first compartment with steel balls of the usual kind, the second with patented Kordt balls and the third with cubes with small balls.




Mill output, in kg. per 5 sec.: I, original charge; II, with Kardt & Roche elements.

After two days, when the mill had been worked in, the hoped-for result had already been obtained. With the regular charge the mill gave the guaranteed capacity of 12,500 kg. per hour and fineness of 2.5 to 4 per cent remainder on the 4,900-mesh (per sq. cm.) screen, with power consumption of 520 hp. and a yield of 24 kg. per hp.-hr. With the improved charge the capacity was increased to a minimum of 15,000 kg. per hour and the fineness to 0.5 to 1 per cent remainder on the 4,900-mesh screen, with power consumption of 540 hp. and a yield of 30 kg. per hp.-hr.

The material was well-burned cement clinker of 10 per cent retained on 1-cm., 40 per cent on 0.5-cm. and 50 per cent on 0.1-cm. sieves. In studying the results, particular importance is given to the fact that fineness is so much increased as to prove particularly important in the production of special high-strength cements. A comparison of photomicrographs of materials from each compartment shows also that the ground particles are cubical and well formed rather than flat as is often the case with regular grinding media.—O. Frey and Dr. Moschitz in *Zement* 19:652-654, July 10, 1930.

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## New Plant for Handling Sand Opened Near Paris

The sand-and-gravel business in the Parisian region, already large before the war, has had such a great expansion in recent years on account of the development of construction in general and particularly of the use of reinforced concrete, that the supply is actually inferior to the demand. Producers are opening new pits and modernizing old operations, and their customers, principally dealers intermediate between the producers and the actual users, are installing modern equipment for handling the materials. Most of the yards are equipped with clamshell cranes, and there is a rapid trend away from the use of steam toward the employment of electricity in driving these equipments.

One of the most up-to-date plants in the Paris region is that of Eug. Clement of Alfortville (Seine) who has a new plant along a lateral canal for receiving, storing and screening sand dredged elsewhere and received by boats. One pair of concrete storage bins, each holding 200 cubic meters, serves for storing pit-run sand unloaded from the boats by a large crane. This sand is loaded through bottom gates into trucks as required. A second pair of bins of the same size serve for holding screened materials. A shaking screen above each bin, driven by a 10-hp. motor and having a capacity of 40 cubic meters per hour, separates the sand into two sizes which are chuted to their respective compartments. Sand for screening is unloaded by one of the cranes to a pit from which it is lifted by a belt-bucket elevator carrying 5-cu.-liter buckets and driven from the same motor as the screen for the respective bin. All unloading from boats, unloading from bins for stockpiling materials on the ground, reloading to the bins, and feeding the elevator hoppers is done by two large electric cranes traveling on rails parallel to the dock. —J. Prouteau in *Mines, Carrieres, Grandes Entreprises* 8:C-133-135, December, 1929.

## Effect of Loam in Sand Used for Cement Mortar

In a communication of the Laboratory for Testing Materials at the Kasaner Polytechnischen Institut, Prof. M. G. Jeltschaninoff reviews a great amount of the literature published concerning the effect of loam impurities in sand on the mechanical properties of portland cement mortar, discussing the investigations of Hain, Lachtin, Alexejew, Germer, Von Blaese, Abramow, Grunn, May, Burchartz, Bach, Federowitsch, Ewald, Walker, Weiss and others. In addition, comprehensive reports are made on three series of tests on this general subject made at the author's laboratory. The writer presents the following conclusions:

(1) Loam impurities in sand are, in general, to be regarded as harmful to portland-cement mortars.

(2) Admixtures of clean loam free from organic materials are admissible in the sand used in portland-cement mortars or concretes in small quantities, according to recent experiences up to 2 per cent after appropriate laboratory testing.

(3) The laboratory testing of loam-bearing sand for the purpose of determining the effect of its loam impurities requires a considerable length of time, measured in months.

(4) The influence of the loam impurities varies according to the condition of the loam. Previous drying of the loamy sand tends to too high values for the mortar strengths and should not be practiced in laboratory procedure.

(5) The influence of the loam impurities varies according to the method of testing. In tensile-strength tests there results, for the admissible content of loam, a higher limit than in compressive-strength tests and therefore conclusions on the effect of the loam content should, by no means, be drawn from tests on tensile strength alone.

(6) The principle that greater density leads to greater strength is not self-sufficient for application to portland-cement mortar.

(7) Gruen's theory of the harmful effect of the colloids produced by the longer action of air on the loam, on the crystalization and other process taking place at the hardening of the cement needs further investigation.

(8) The question of the effect of loam impurities in the sand on the properties of portland-cement mortar cannot yet be considered as solved and calls for more researches.—Prof. M. G. Jeltschaninoff in *Zement* 19:556-560 and 580-585, June 12 and June 19, 1930.

# Suggested Topics for Discussion at the October Safety Meeting

TWO timely topics for your October safety meetings are the following: A detailed report from one or more persons who attended the Nineteenth Annual Safety Congress and Exposition held at Pittsburgh, Pa., Sept. 29 to Oct. 3; and a report by a committee which has made an outside safety inspection of your plant.

If your plant has had one or more delegates in attendance at the Safety Congress, then it will be proper that your plant safety committee and all plant employees have the privilege of a detailed Congress report.

It should be realized, first, just what the Annual Safety Congress means. These Congresses, for a number of years, have been the greatest assemblies in the world, devoted exclusively to problems of safety and the conservation of human life. They have been called Safety Universities, since they usually have 100 or more special sessions, several hundred speakers who include many of the leading safety authorities in the country, and they are attended by thousands of delegates from all states of the Union and a number of foreign countries. These Congresses are a remarkable evidence of the growth and the practical value of the safety movement in the United States, which leads the entire world in a practical recognition of the safety problem.

In presenting the report on the Safety Congress, the speaker or speakers might be asked to answer such questions as:

1. Did the Congress as a whole make a good impression on you?
2. Are such meetings worth while?
3. Should our plant be represented at next year's Congress? By whom?
4. What special features of the Congress made the most lasting impression on you?
5. Did the Congress, in general, and especially the meetings of the Quarry Section, cause you to think of certain conditions in this plant that should be improved from a safety point of view?
6. Which speakers in the general sessions, and in the Quarry Section meetings, did you particularly enjoy?
7. What did you learn from those speakers that can be adapted for use in this plant?
8. What representatives from other plants did you meet?
9. What did you learn from these individuals that you could not have learned in a safety meeting?
10. Explain what you saw at the safety exhibit that can be used in this plant.

11. Were you able to help others whom you met by telling them of things accomplished in this plant?

For your outside-plant safety inspection, either a sub-committee or your entire safety committee might be asked to make a report. This report probably should include the whole plant. But, if your plant is a large one, it possibly might be best to make an inspection of only certain features, or possibly appoint several sub-committees to investigate different features of the outside safety of the plant.

It is generally realized that many problems are involved in safety inspection. It is the business of the best type of safety inspector to locate accident causes and then to find ways and means for their correction. Therefore, when such an inspector investigates a hazardous condition, he will, at the same time, attempt to formulate some plan for the correction of this condition. It should be realized that safety inspectors—and this applies especially to the persons in the plant who make safety inspections their chief business—do not have any "snaps" before them.

The safety inspector usually cannot do a thorough job without meeting objections; and once in a while he may even "step on someone's toes." It is a high art to be able to carry on safety inspection work effectively and, at the same time, retain the friendship of all persons. To accomplish this requires a high degree of diplomacy, tact, a full measure of honesty, a square jaw, and a strong backbone. Everlasting cheerfulness also will help a lot.

Every competent safety inspector, of course, realizes that the chief value of his inspection work is educational. While he is inspecting, he is helping to educate those with whom he comes in contact. A true type of safety inspector does not gain pleasure from "getting something" on someone else. A real safety inspector is always looking for opportunities to help his fellow workers to overcome the tendencies or the habits which may result in plant-accident hazards.

Here are some suggested questions which those who make the outside-plant safety inspection might keep in mind:

1. Is traffic at the plant entrance as well regulated as it should be from the viewpoint of safety?
2. Are driveways within the plant as well protected as they should be with safety signs?
3. What suggestions can be made for improved lighting of driveways and for accident prevention during short winter evenings and at night?
4. Are the plant railroad grade crossings, or railroad crossings near the plant, properly protected?
5. What about automobile speed regulations within the plant?
6. Are the plant roadways and walks as free as they should be from piled material and other obstructions?
7. What about the safety of pedestrians in the plant—relating to automobiles, railroad crossings, slippery walks, outside stairs or steps?
8. Are there any plant hazards to pedestrians from possible falling materials?
9. Are there winter dangers from falling ice and snow from roofs, sheds, or elevated ground?
10. What safety suggestions for outside-plant housekeeping?
11. How can pedestrians assist in outside-plant safety?
12. How can automobile drivers assist in outside-plant safety?
13. What were the causes of some of the outside-plant accidents during the past year?
14. From the viewpoint of outside-plant hazards, are the first-aid stations of the plant properly located?

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## New Bridge to Connect Old and New Workings

The Kelley Island Lime and Transport Co., of Kelley Island, O., has completed plans for the preparation and working of its new quarry. Preliminary construction work is under way. A new concrete and steel bridge connecting the old and new quarries is being built at a cost of $5,000 and the company's 25-ton stripping shovel is already at work on the new site. Flux limestone is produced and it is said that a sufficient supply for 45 or 50 years is available in the deposit.

# Recent Patents

## AMERICAN

**Burning and Drying**

*Sand dryer.* Volner Foster, Chicago, Ill. No. 1,773,984.

**Crushing and Grinding**

*Grinding and separating mill.* Erwin Jungles, Geislingen-Steige, Germany. No. 1,773,228.

*Crusher.* George E. Chamberlain, Decatur, Ill. No. 1,773,476.

*Machine for crushing ore, stone, and the like.* John W. Ericsson, Svedala, Sweden. No. 1,773,616.

*Grinding mill.* Josef Klagsbrunn, Vienna, Austria. No. 1,773,906.

*Rock crusher.* Carl G. A. Schmidt, Jr., Kennett Square, Pa., assignor to American Road Machinery Co., same place. No. 1,774,159.

*Apparatus for reducing gravel to sand.* Bernard J. Coomes, Algonquin, Ill. No. 1,774,318.

**Excavating and Loading**

*Excavating machine.* William M. Bager and Werner Lehman, South Milwaukee, Wis., assignors to Bucyrus-Erie Co., same place. No. 1,773,252.

*Loading apparatus.* James P. Dovel, Birmingham, Ala. No. 1,773,478.

*Loading machine.* Alexander D. Ferguson, Michigan City, Ind., assignor to Sullivan Machinery Co., Claremont, N. H. No. 1,773,527.

*Boom-angle indicator for cranes.* Erich H. Lichtenberg, Milwaukee, Wis., assignor to Koehring Co., same place. No. 1,773,589.

*Mining machine.* Louis F. Hess, Ansted, W. Va., assignor to Daniel Boone Mining Machine Co., Beckley, W. Va. No. 1,774,006.

*Mining machine.* Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,774,485.

**Miscellaneous**

*Device for dewatering sand and gravel.* Edward P. Escher, Detroit, Mich., assignor to Stephens-Adamson Mfg. Co., Aurora, Ill. No. 1,773,479.

*Sand-slinging machine.* Erik P. Jansson, Eksjo, Sweden. No. 1,773,694.

**Screening**

*Vibration screen.* Gustave A. Overstrom, Pasadena, Calif. No. 1,733,405.

**Transportation**

*Creeping traction mounting.* William M. Bager and Werner Lehman, South Milwaukee, Wis., assignors to Bucyrus-Erie Co., same place. No. 1,773,253.

*Mine car.* Victor Willoughby, Ridgewood, N. J., assignor to American Car & Foundry Co., New York, N. Y. No. 1,774,344.

## FOREIGN

**Cement**

*Manufacture of cement.* British Portland Cement Manufacturers, Ltd., S. G. S. Panisset and W. S. Hannah. British 331,584.

*Method and apparatus for the combustion of pulverized fuel, more particularly pulverized coal.* J. P. Goossens. British 331,555.

*Method of burning pulverized fuels.* M. A. Hanna Co. Canadian 302,570.

Pulverized coal firing. Allgemeine Electricitaets - Gesellschaft. German 504,221.

**Gypsum**

*Process for the manufacture of a building material from binding substances which harden with water, as for instance, Sorelcement or gypsum, and bituminous substances.* L. C. Schilling. British 303,889.

*Plaster composition.* Gordon R. Walper. Canadian 302,656.

**Kilns**

*Kilns or furnaces for the calcination, burning or roasting of limestone, iron ore, chalk, and the like, or for similar purposes.* C. F. Priest. British 332,037.

*Method and apparatus for firing tunnel kilns.* Nicola Lengersdorff. German 503,355.

*Rotary kiln.* Friedr. Krupp Grusonwerk Akt.-Ges. German 503,328.

*Rotary kiln and cooler.* G. Polysius Akt.-Ges. German 503,464.

*Drawing device for shaft kilns.* Ludwig Koenig. German 503,329.

*Shaft kiln drawing apparatus.* Ludwig Koenig. German 503,330.

*Trommel for preparing raw material for kilns.* Arno Andreas. German 504,232.

**Material-Handling**

*Conveying apparatus.* A. G. Enock. British 331,502.

*Jigger conveyors.* T. G. Nyborg and M. F. Higgins. British 331,551.

*Pneumatic conveying of coal and other materials.* Dorman, Long & Co., Ltd., and M. R. Kirby. British 331,694.

*Conveyors.* J. W. Greer. British 331,896.

*Oscillating conveyors.* L. J. E. Boileau. British 331,957.

*Means for altering the alignment of a conveyor or other belt at different parts of its travel.* A. Hopkinson. British 332,078.

*Compensating device for shuttle-type aerial tramways.* Adolf Bleichert & Co. Akt.-Ges. French 690,189.

*Endless conveyor.* Soc. Anon. de la Chaine Cablee. French 690,582.

*Bucket elevators.* Humphreys & Glasgow, Ltd. French 690,683.

*Bucket.* The Hayward Co. (Herbert S. Atkinson). Canadian 302,512.

*Drive for belt conveyors.* Gesellschaft fuer Foerderanlagen Ernst Heckel G. m. b. H. German 503,488.

*Feeder device.* J. Pohlig Akt.-Ges. German 503,470.

*Shaking trough conveyor.* F. W. Moll Soehne. German 504,107.

*Attachment of shaking conveyor drive.* Gebr. Eickhoff. German 503,796.

*Automatic rotary dumper.* Franz Schmied. German 503,886.

*Side dumper for pit operation.* F. W. Moll Soehne. German 504,068.

**Mixers**

*Apparatus for the preparation of mixes of solid substances with liquids, in particular of mixes of concrete or mortar containing a regulated quantity of liquid.* P. Volgsamer. French 690,747.

**Pumps**

*Piston pump for raising viscous mixtures such as concrete, mortar or the like.* M. Giese and F. Hell. British 319,347.

*Centrifugal pumps, rotary compressors and the like.* H. E. Dixon (A. Bargeboer and Maschinenfabrik Geb. Stork & Co.) British 331,904.

**Sacking**

*Valve bags for cement or other powdery or granular materials.* W. A. Merrick and C. T. Frost. British 332,058.

*Apparatus for labeling cement sacks.* Compagnie des Sacs a Valve Bates, Soc. Anon. French 690,658.

**Separating**

*Apparatus for dust separation.* E. C. Jacques and Societe Nouvelle de Metallisation. French 690,560.

*Separator for pulverized solid materials.* Societe Anonyme des Appareils de Manutention et Fours Stein. French 690,575.

*Air separator.* Georg Roth. German 503,663.

*Process and apparatus for dust separation.* Dr.-Ing. August Hildenbrand. German 503,664.

*Dust collector.* Associated Lead Manufacturers, Ltd. German 503,665.

*Dust collector.* New Haven Sand Blast Co. German 504,197.

**Miscellaneous**

*Means for taking samples of earth or the like at different depths.* A. T. L. Wilson. British 331,726.

*Pit props.* A. Baird & Son, Ltd., and H. A. Haird. British 332,026.

*Rotary pump for handling solids in suspension.* American Manganese Steel Co. Canadian 302,058.

*Waste heat boiler.* Babcock-Wilcox & Goldie-McCulloch, Ltd. (Herman Brackett Smith.) Canadian 302,509.

*Building block machine.* Nepperhan Concrete Products Corp. (Louis Gelbman.) Canadian 302,597.

*Rope-holding clip.* Norman T. Finn. Canadian 302,214.

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited above. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

# Legal Information for Operators

## Material Man Authorized To Collect from Owner

It has been said that a materialman is a person in trade, who does not follow the business of contracting to build houses for others, but who keeps for sale some materials that enter largely into buildings. On the other hand, it must be admitted that if this definition should be literally accepted, anyone who contracts to build houses would be excluded from its terms notwithstanding he might have a yard, store, supply house, warehouse, or other place where he keeps building material for sale to other builders and contractors. Therefore, the Courts have adopted the uniform rule that any firm or person, who supplies building material, is a materialman and entitled to a lien on property to secure payment.

For example, in Watson v. Murphey, 285 Pac. 1037, it was disclosed that an owner contracted with a subcontractor to perform construction work. The subcontractor purchased the building material from a man named Murphey, because the latter had credit and the subcontractor could not obtain credit from the materialmen. The owner paid the subcontractor who failed to pay Murphey. The latter filed a mechanic's lien. The owner attempted to avoid liability on the contention that Murphey was not engaged regularly in selling building material and that the owner had no contractual relations with him. However, the higher Court held Murphey entitled to a lien, saying:

"Defendant (owner) says, if the lien be allowed, under the facts of this case, the owner has no way of protecting himself. If that were true, it would be the fault of the law, but we do not agree that the owner cannot protect himself. He (owner) could take from the contractor a bond, or, neglecting to do that, he could make sure by inquiry and investigation as to who is furnishing the material and see to it that payments made on account are properly applied. Defendant took neither of these precautions, and, while it is a misfortune and a serious hardship to have to pay the second time, it all arises from his placing too much faith and confidence in Tomlinson (subcontractor)."

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## Freight Overcharges Are Not Easily Determined

It is important to know that a judgment for freight overcharge cannot be based upon an average taken from a few cars. The complaining party is bound to prove the actual and total overcharge.

For instance, in Gulf, C. & S. F. Ry. Co. v. Minton, 24 S. W. (2d) 12, it was disclosed that a purchaser of gravel arranged to have it weighed on the gravel company's scales at the pit. After 600 cars had been shipped by rail, the purchaser requested the railway company to select four cars of gravel, at random, and weigh these four cars on its scales. The railway company complied with this request. One of these cars weighed 1,400 lb. less than it had on the gravel company's scales, another weighed 4,900 lb. less, and still another weighed 6,300 lb. less. The fourth car weighed 820 lb. more.

Therefore, the purchaser had the gravel company reduce its bill to conform to the average shortage, and then sued the railway company to recover freight overcharge on the 600 cars. The lower Court allowed a judgment of $2,102, based upon the average short weight determined by weighing the four cars. In other words, the lower Court ascertained the amount of overcharge, not by having the weights on each of the 600 cars shipped, but by taking the weights of only four cars and arriving from these weights at an *average* weight per cubic yard.

The higher Court reversed this judgment, stating the following important law: "The law placed the burden on the plaintiff to establish his damage and the actual extent thereof. In this case the only way the plaintiff could show damage would be by showing that he was overcharged freight on the 600-odd cars shipped and, in order to substantiate his claim for damage, it should become necessary for him to show the difference between the actual weight of *each* of these 600 cars and the weight upon which he was charged freight. . . . There was no attempt to prove the correct weight of the 600 cars, but the judgment below is based upon only an estimated weight, figured from an average of the cubic yardage of the four cars weighed on the railroad's scales at another point. There was no legal evidence upon which to base the judgment."

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## Employer is Liable For Injury to Employee

Many persons are under the erroneous belief that an employer is not liable under state compensation laws for injuries to employees, if testimony is introduced proving that, when the injury was sustained, the employee was doing work for his employer who would not earn a profit on the job.

For example, in the leading case of Modlin v. Twin Falls Canal Co., 286 Pac. 612, it was disclosed that an employee, employed to operate a rock-drilling machine, was seriously injured while attending to his regular duties. The employee sued for compensation and his employer argued that no liability exists because the job being done was not netting a profit. However, the Court held the employee entitled to compensation, saying:

"It is urged that respondent (employer) was not in this particular enterprise for pecuniary gain. Whether it made a profit or not is beside the issue. It was supplying service and receiving remuneration for it. If it made no profit, it but shared the fortune of any other contractor who has finished a job, out in pocket or barely even."

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## Must Credit Owner With Payments for Materials

Generally speaking, a materialman is obligated to apply payments, received from a contractor, to the account of the owner from whom the materialman knows the contractor received payment. Moreover, the Court may infer from the circumstances that the materialman received the money from a particular owner.

For illustration, in Madison Lumber Co. v. Federal Surety Co., 128 So. 50, it was disclosed that a contractor contracted to construct a dwelling. A materialman, who furnished $1,513 worth of rock and other materials sent a collector named Wild to collect the money from the contractor. Wild gave the contractor a bill for $1,513 Wild took the latter's check, receipted the bill and handed it back to the contractor. However, when Wild returned to the office, the bookkeeper discovered that the contractor had been indebted to the materialman on old accounts in the sum of $324.42, and thereupon a portion of the check given in payment for the other bill was imputed to the payment of the old account and, thus, the new account was left showing a balance due amounting to $324.42.

In holding the materialman bound to credit the new account with the $324.42, the Court said: "We find it unnecessary to discuss the question of whether or not plaintiff (materialman) had knowledge as to the source from which the funds were derived. . . . We find it very difficult to believe that a furnisher of materials, constantly calling upon the contractor for money, and whose collector, as was shown here, called at the work two or three times each day, had no knowledge of the fact that so large a sum as $1,500 had been derived from the owner of the work."

# Insurance Problems Discussed

## What Business is Worth After Death of Partner

A series of articles in this department, one year ago, outlined the reasons why life insurance has come to fill an important part in all programs for the stabilization and continuity of business. During the intervening time a considerable volume of new insurance has been sold for purely business purposes, and the more widespread distribution has led toward clarifying the problems involved in this modern device.

As has been pointed out, when one member of a partnership dies (or one of the active heads of a closed corporation which is, in essence, a partnership), the surviving partner must do one of three things: (1) sell out the business for cash; (2) start a new partnership with the widow, son, nephew or other heir of his former partner; or (3) buy out the interest of the deceased.

The first of these options inflicts a loss on both the owners and the community, because it is never good economics to close up a going concern. The second option carries the risk that the new partner may create friction or may not be qualified. The third option is ideal because it puts the business into the hands of the survivor who is able to utilize it, and permits the widow to transfer her money to more conservative investments. A contract of sale is required between the partners and life insurance to provide the cash needed for carrying through the purchase at death.

### Elements of Sale

Such a partnership deal involves three problems:

(1) How to draw up a contract of sale. Your lawyer must do this.

(2) How to write the insurance properly. This will be answered in a later article.

(3) How to value the business. This question is discussed below.

Suppose you and your partner own a business which is paying you a nice steady income, and someone comes along wanting to buy you out. What will you sell for?

### Forced Sale Price

Or, suppose times are bad, your profits are temporarily low, and you have to sell out under forced conditions. You could not get what you think the business is worth, could you?

Or, suppose you and your partner are both killed in the same automobile accident. How much could your estates get out of the business?

The same business, you see, has different values at different times. External events over which the partners have no control (such as general economic conditions and accidents) affect the net worth tremendously and any formula for estimating the net worth must therefore be flexible.

Even if you consider your business in a static condition—for example, assume that the worth today is permanent—there are at least three different valuations for it, each of which is correct and logical from a certain point of view.

### Balance Sheet Insufficient

In the first place you have your balance sheet. This gives the net worth only from the standpoint of a banker. It is a proper basis for making loans, but it is not a reasonable sale price. In good times, you would want a bonus and, in hard times, you could hardly get your money out.

A second estimate would be the liquidating value. If you were to wind up your firm, you would find that some of your equipment would be sold as junk and some of your accounts receivable would not bring one hundred cents on the dollar in an emergency. It is a healthy thing to take a look at this forced-sale value because it gives you a true picture of what the business would be worth to your widow. But, of course, it is not a reasonable basis for business life insurance.

### Value as Going Concern

The figure which we want to estimate, for our present purposes, is the value of the business as a going concern. This includes the net worth, as shown on the balance sheet, plus a fair appraisal of the good will.

If you propose to secure for your family all they are entitled to, you must include every cent of physical value plus an allowance for your personality or services in producing the profits of the business.

When we speak of business life insurance, we give this name to a certain transaction largely because insurance underwriters have been the aggressive leaders in putting this over. As a matter of fact, we really are dealing with a contract between two (or more) partners for the purchase of the entire business by the survivor on the death of one.

The contract is the essential, insurance being only a side-line which furnishes the cash for carrying through the deal. The contract must determine the purchase price. It should do this, however, without naming a fixed price, because the value is constantly changing. It should name a method for measuring the value which will be adequate under all conditions of booms and depressions. Four methods are now used for this purpose, as follows:

### Four Methods

(1) The partnership agreement may say that the insurance is the full purchase price; that is, upon a death, the widow gets the proceeds of the policies and the survivor gets title to the entire business with no other formalities. To make this plan work, the partners must check up once a year or oftener to see if more insurance is needed to keep pace with the growth of business.

(2) The sale price may be the book value, either on the date of death or as of the close of the last fiscal year.

(3) The value may be left to an independent audit by a certified public accountant.

(4) The sale price may be determined by a neutral appraisal. The survivor and the deceased's executor would each appoint an appraiser and these two would choose an umpire to act with them.

### Which Method Is Best?

The outstanding characteristics of each of the foregoing methods is as follows:

(1) This is by far the simplest plan. It is fair, because it represents what the active partners themselves think the business is worth. Its only danger is that the owners may neglect to keep it up-to-date as business expands.

(2) Book value alone has the serious objection that it makes no allowance for good will, or the worth of personality and brains.

(3) This method is accurate, but there may be a fight over the choice of an auditor.

(4) A neutral appraisal is free from the risk of lawsuits and allows the fairest scope for estimating the goodwill value. Its success, however, depends on whether competent technical men are chosen and are available for this service.

As to which of these plans is best, we can say only that all have been used and each firm must select the one which seems to fit its situation. Under the second, third and fourth methods, the insurance proceeds constitute the first payment to the deceased partner's estate. If the sale price exceeds the amount of insurance, the survivor should be allowed one year or more to pay the difference.

### Good Will

There remains now only the calculation of good will, which must be added to the net worth to make up the sale price. This is a problem of accountancy rather than of insurance, and you should call in a public accountant for the best advice. Just for informal figuring, however, we may suggest that good will, or the value of individual personalities, is the net profit for a period of from three to five years, minus a six-per cent return on the invested capital. This period represents about the length of time that the value of a good executive is projected into the future of his organization.

# New Machinery and Supplies

## New Plastic Compound Has Expansion Feature

The Quigley Co., Inc., located at 56 W. 45th St., New York, N. Y., manufacturer of Hytempite and Triple-A protective coatings, announces a plastic, expansive compound for sealing joints, called Q-SEAL.

The compounding of this material was made possible by the discovery of a mineral which is not only a natural lubricant and preserver of metal, but which, when subjected to heat, expands to several times its normal volume. This mineral is ground to a very fine mesh and is used as the principal pigment in compounding. The principal vehicle or mixing agent used is one that is impervious to crude oils, all of their derivatives, and acids, and is non-corrosive.

Lift-truck.

## Hydraulic-Lift Trucks Possess New Features

The Barrett-Cravens Co., Chicago, Ill., announces the new Barrett Red Head lift-trucks, which have the following exclusive features: The spring handle holdup which prevents the handle from falling on the floor, an automatic latch which prevents the handle from flying up when released, a special long leverage lifting mechanism which, the makers affirm, is guarnteed to lift the load 25 per cent more easily than other trucks of the same capacity, and, finally, Timken roller bearings with Alemite lubrication.

The hydraulic check located under the center of the load is provided with a stuffing box eliminating the possibility of oil leakage which causes loads to go down with a bang.

The latest and most refined improvements in hand-operated trucks have been incorporated in the Barrett line and are backed by an unqualified guarantee.

## New Automatic Starters For Low or High Speed

A new line of enclosed automatic motor starters for two-speed, separate-winding type squirrel-cage motors, is announced by the Cutler-Hammer, Inc., Milwaukee, Wis. These starters, to be known as Bul. 9736, are the across-the-line type, the windings connected directly to the line. Both windings are protected against dangerous overloads by means of thermal overload relays. A pushbutton master switch with "stop," "low" and "high" buttons is used to obtain control from a remote point.

Starters can be furnished in three types: for starting on either winding, with sequence compelling feature, or with automatic sequence control relay; for starting on either winding, depressing either the low or high button starts the motor on the respective low or high speed winding. The sequence compelling feature requires that the motor always be started at low speed before transferring to high speed. Depressing the high button will not start the motor. The automatic sequence control relay insures that the motor will always start at low speed and pass to high speed automatically if the high button is depressed. On all three types, if the motor is operating at one speed, it can be transferred to the other speed by simply depressing the other speed button, it being unnecessary to stop the motor.

Automatic starter.

The mechanism, which consists of two magnetic contactors mechanically interlocked, and two sets of thermal overload relays, one for each winding, is mounted in a split-type enclosing case which, when opened, provides easy access to the various operating parts. Ample wiring space and conduit knockout holes for any size conduit which might be used, make installation and wiring easy. Bulletin 9736, describing these starters in detail, will be sent on request to the manufacturers.

## Novel Combination of Equipment Saves Time

A slight change in its plant set-up has enabled the Woodstock Slag Corp. of Birmingham, Ala., to operate two mixers simultaneously under one bin, with as short a mixing time as one minute. This company has, for several years, produced ready-mixed concrete for contractors in and around Birmingham, and the new set-up has practically doubled the plant capacity.

The original plant set-up included a 4-compartment bin, one weighing batcher, and two T. L. Smith tilting mixers. The latter, one a 28-S and the other a 56-S, were placed back to back. With this arrangement it was only possible to operate one mixer at a time, unless an exceedingly long mixing time was specified. It was impossible to add another weighing batcher without completely redesigning the bin.

By building chutes from the four bin compartments directly to the mixer hopper, and installing a Smith 56-S Weigh-Mix in place of the 28-S mixer, the owner was enabled to operate both mixers at the same time, even with a one-minute mix. The weighing-hopper proportions the batch for the one mixer, and the Smith Weigh-Mix for the other. The change in the set-up involved very little additional expenditure and yet it enabled the owner to double his concrete production.

Novel mixer set-up.

## New Respirator Guards Workers from Dusty Air

Safety is just as much an asset or a liability as the physical properties on the books of any company. If it is not made an asset, neglect to do so automatically creates a great liability.

Leading sand and gravel producing companies have for some time been giving more and more attention to the problem of safeguarding the health of their men working at operations necessarily in atmospheres of flying dust and grit.

Their reasons for attempting to improve health conditions are not selfish or mercenary although many instances of loss of health have cost thousands of dollars. Instead they have been prompted from a humanitarian aspect, to make an effort to improve as much as possible the conditions regarding health of the workman who, at best, does not have a very pleasant job.

One of the difficulties encountered in this work is in getting the men to wear safety devices. Only the most comfortable and efficient respirators can be sure of constant use. Because the men do not always realize the danger to their health, many will not readily wear anything not perfectly comfortable.

Outstanding among developments in safety devices during the past year and of particular interest to the pit and quarry industry is the new type respirator or breathing mask recently announced by Willson Products, Inc., Reading, Pa.

This company, co-operating and in direct touch with a large industrial company, has been working on this type of mask for many months but did not offer it for general use until it had been thoroughly tried, tested and changed many times.

Filling a definite need in industry, this mask is being accorded a generous reception by many trades where various operations are necessarily in atmospheres of dry dust. With a large area of breathing space, the bag filter, used dry, offers no interference with speech or breathing. Full freedom of vision is allowed and eye glasses or safety goggles can be worn with it.

New type of respirator.

Designed for comfort as well as efficiency, no part touches the face except the soft filter bag which folds back over an anatomically shaped rubber form and is kept distended by a ball-shaped light wire spring. Economical, too, the filters can be washed and used many times over. All parts are interchangeable and replaceable without tools.

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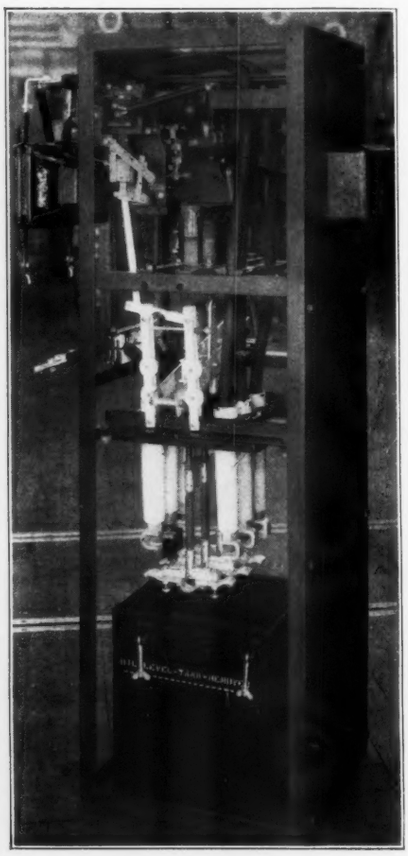
## Magnetic Switches for Heavy-Current Control

The General Electric Company announces the CR-7006-T-5 oil-immersed magnetic switches for heavy-current duty in controlling large sizes of motors. The new switches supersede the G. E. CR-7006-T-3, 150-amp. magnetic switch. They consist of a three-pole, 200-amp. oil-immersed contactor, a temperature overload relay, two current transformers and an undervoltage relay all mounted on a suitable floor-mounted framework, which is built with steel front.



Oil-immersed magnetic switch.

Instantaneous undervoltage protection is obtained with one form when used with a drum switch. Time delay undervoltage protection is obtained with the other form when used with momentary contact type push button control.

For standard motors the switches are rated 750 hp. at 2,500 v., and 1,200 hp. at 4,000 v. They have an approximate weight of 525 pounds and require 5½ gal. of oil each. These switches may be used on 6,600 v., 750 hp. max., by providing 6,600 v. current transformers.

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## Portable Sump Pump Runs by Compressed Air

A new portable sump pump which embodies several outstanding features has been developed by the Chicago Pneumatic Tool Co., New York, N. Y. This unit, known as the CP Quimby sump pump, is an air-operated pump, driven by the CP No. 88 rotary air motor. This pump is sturdily built, weighs but 44 lb. and has a capacity of 100 g.p.m. at a 28-ft. head.

Portable sump pump.

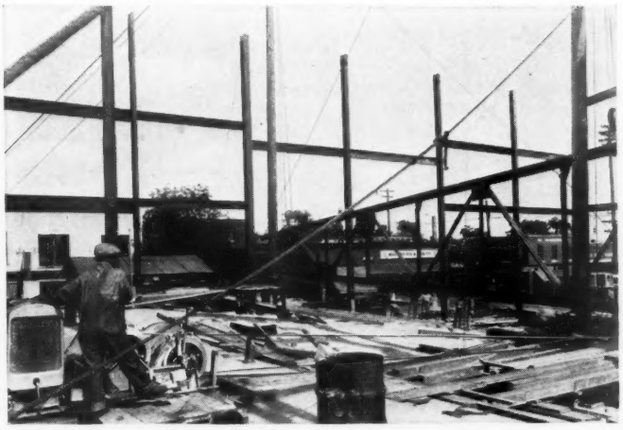
Most of the small pumps in use today for draining manholes or pits are of the suction type which, when placed for operation above the level of the water, require priming before they start to pump. The usual maximum lift of such pumps is not more than 20 ft. With the Quimby pump steady capacities may be obtained up to 50 ft. All that is necessary for this fast-pumping unit is to start the motor running before submersion and lower the complete unit into the manhole or pit to be drained.

## Hoist Contains Direct Positive Thrust-Action

The Jaeger Machine Co., Columbus, O., manufactures what are termed thrust hoists in which friction is obtained by means of a positive thrust action, using asbestos compound blocks. Friction return and release are attained by the same screw action of the thrust. Thrust and release springs are entirely eliminated.

One of the many applications of these outfits, which are being used in all sections of the country, is that of erecting steel trusses. Two gin poles are placed and so connected that one drum line leads to each pole. Featherweight controls and positive breaks enable the operator to set the truss in the exact position. This simple and effective method is being used by M. E. Gillroy, of Menet, Mo., who operates a 32-hp. Jaeger Timkin thrust hoist. This type of outfit finds general application for pile driving, draglines, material hoisting and in connection with Lakewood or other mast plants or towers, and for steel erection. Two models are built, single and double drum, ranging from 10-hp. to 50-hp.

Sales and service are provided from Mexico to Canada by more than 100 Jaeger distributors.



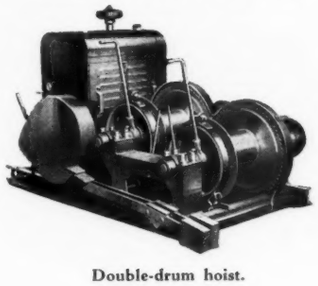
Friction thrust hoist.

## New Gas and Electric Hoists Have Two Drums

A new line of gasoline or electric powered hoists in seven sizes, ranging from 2-hp. to 27-hp. has been announced by the Dake Engine Co., Grand Haven, Mich. Following the usual Dake design, the side frames which support the shaft bearings and the base are made in one piece. In the five sizes up to 20-hp., the frame is made entirely of steel, electric-arc welded. The steel channels, which are the side members of the base, serve as skids and are drilled for holding-down bolts and anchor chains. The cross members of the frames are angles and tubes. The hoisting drums with ratchets and brake drums are also of one piece electric-arc-welded steel construction.

Bronze-bushed cams running on the drum shaft engage the friction clutch and two ball thrust bearings minimize the operating lever pull.

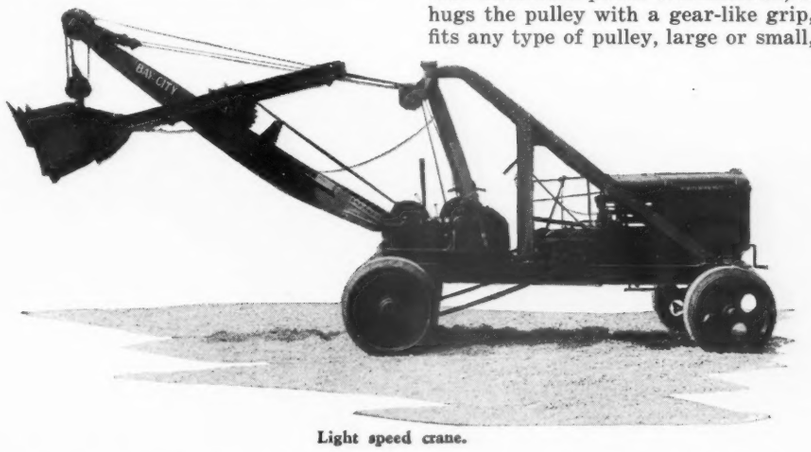
The brakes are of the band type with one fixed end, the bands being made in two parts and fastened together with an adjusting bolt conveniently placed on the top of the drum. They are operated by a rocker and lever, so that the brakes are smooth, positive and applied with a light pedal force.



Double-drum hoist.

## Adaptation of Crawler Has Rubber-Tired Wheels

Bay City Shovels, Inc., Bay City, Mich., announces the **Cranemobile,** an adaptation of the crawler mounted tractor model. No change is made in the machinery, superstructure or booms and buckets. In place of crawlers heavy steel wheels with large solid rubber tires are substituted, permitting faster travel speeds and eliminating crawler wear for long or fast moves. Special heavy duty forged Timken front axle is provided with roller bearings. Steering mechanism is provided under tractor end of machine. The **Cranemobile** is intended for any material handling job where a truck crane would normally be used, or where a fast moving and operating machine is desired for work on hard or relatively smooth ground.

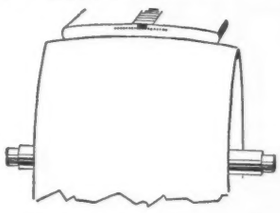



Light speed crane.

## Belt Fits Any Type of Large or Small Pulley

A new construction in transmission belting is announced by Cincinnati Rubber Mfg. Co., Cincinnati, Ohio. This new belt, which is called *Cincinnatus Duoflex* because of its duo-flexibility both crosswise and lengthwise, is designed to give greater pulley contact, thus delivering more horsepower. It is built to fit all kinds of pulleys, flat or heavy crowned, large or small, with a gear-like grip. The reason for the close pulley hug is an automobile tire cord insert giving remarkable crosswise flexibility and exceptional adhesion under the seam. Where many belts slip and strain, this belt operates with slack, delivering greater horsepower and longer service and life with less fastener trouble.

Duoflex belting is a development of practical experience and scientific engineering, factory tested to meet every demand for greater power transmission in modern high speed production. The general advantages of this belt are: Maximum power transmission, it hugs the pulley with a gear-like grip, fits any type of pulley, large or small, regardless of crown, evenly and securely, can be operated with more slack, less tension, and consequently less strain on fasteners, less belt tension, resulting in less slippage, longer life, and better service, and, finally, flexibility combined with the great strength of the hard duck body makes it one of the best belts for modern high speed operation.

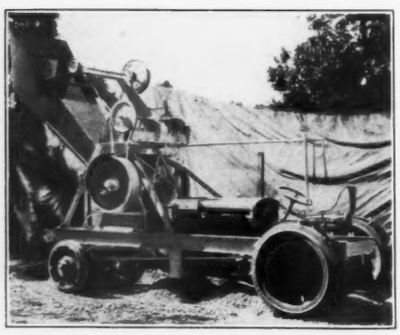


Showing how belt, with crosswise flexibility, hugs crown of pulley.

## Three Machines Combine Complete Roadway Plant

The Pre-Mix plant, Road-Mix machine, and Tractor-mounted crusher with skip hoist, are three of the most important 1930 contributions made to the science of road building by the Iowa Manufacturing Co., Cedar Rapids, Ia.

The portable pre-mix plant, designed to solve the perplexing questions of durable secondary roads at moderate costs and to meet the engineering obstacles associated with road processing, has proved, after considerable experimentation, to be more economical and to overcome the major weaknesses of the road processing method. The pre-mix plant has overcome engineering obstacles such as fear of moisture and rain or danger of a mix which would not be uniform, by eliminating moisture with a drier unit and by controlling the aggregate and oil. The pre-mix plant makes available for immediate use a properly mixed oil-and-gravel road-surfacing material which makes it possible, without exhorbitant expense, for every county and every township to be intersected by a system of all-weather roads sufficiently durable to withstand the strain of steady traffic every month in the year, and requiring practically no maintenance.



Complete highway plant.

The road-mix machine is a single unit designed to mix aggregate which is already on the road and to serve as a go-between for road processing and pre-mix plants. It is especially beneficial to state highway commissions, county engineers, and township supervisors in sections of the country where the roads have a gravel surface in that no new aggregate would have to be purchased and that the cost of a road-mix machine is approximately one-fourth the price necessary to purchase a road-processing unit. The Road-Mixer works in the following manner: After the aggregate is bladed into a windrow the Road-Mixer moves along at a speed of 2½ ft. to 8 ft. per minute, picking it up over a six-foot width, putting it through a batcher which mixes the aggregate with heated oil in the desired proportion. The material then travels through the pug mill, where it is thoroughly mixed before being discharged on the road, to be bladed into position.

The Tractor-mounted crusher with skip-hoist is, in reality, a unit of the road-mix machine in that it cooperates with the road-mixer on roads with a high percentage of oversize in the aggregate. This unit is designed to crush the oversize which is in the windrow. The skip-hoist picks up the aggregate and deposits it into the crusher where a unified stone is

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## Light Crane Equipped For Speedy Operation

The G. C. Lind Co., Oak Park, Ill., announces the Tractocrane, a light, speedy crane tractor, mounted on a chassis having a 13-ft. 7-in. wheel base, drive wheels 40-in. by 10-in., equipped with solid rubber tires. This machine is specially adapted to light work, loading trucks and railroad cars with gravel, excavating for building foundations and pits, laying pipe in trenches and back-filling over pipe and, in short, any work suitable for a light machine. The standard equipment includes a clamshell bucket or fall block and swivel-hook, friction-clutch-controlled worm-gear boom hoist, ratchet friction drum for opening and closing line, automatic drum for bucket hold line and friction clutch holding mechanism.

These units are also specially equipped on request for pile driving or with lifting magnets and, in fact, any combination desired by the user.

The Tractocrane has convinced the most skeptical that, although small in size compared with the old-style, large, cumbersome cranes, it can be used to perform work far in excess of what might be expected when size only is considered. The operator's seat and position of the control levers have been so arranged that it is possible for an inexperienced man to become a proficient operator in a short time. The operator always faces the load handled, as he rides with the boom.

Driver faces the load.

These units can be equipped also with dipper-shovel and crawler mounting.

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## Standard Tractors Have New Dump Mechanism

The Hughes-Keenan Co., of Mansfield, O., announces an adaptation of its dump body, with complete dumping mechanism, mounted on any one of several standard tractors. This development goes under the trade name of the Iron Mule and is a powerful, rugged unit, specially designed for the moving of rock and other materials. While ordinarily at its best on hauls up to a maximum of about 600 ft, it can be used economically on either short or long hauls under severe conditions, where teams or trucks cannot operate. This has been accomplished by observing the principle that a load is more easily pulled than pushed. The direction of the drive of the tractor has been changed

Forward-dumping tractor.

by reversing the drive gears in the rear axle. The large front wheels are drive wheels and pull the load. This pulling traction enables the iron mule to keep going with a full load in mud or soft earth where teams or trucks cannot operate successfully.

No change is made in the transmission, but the driver's seat and operating mechanism are changed so that the driver faces the load, affording an unobstructed view over the top as well as to the sides, enabling him to spot the machine exactly where desired.

Either McCormick-Deering or Allis-Chalmers industrial tractors are furnished. The body capacity is 2 cu. yd. level full and 2½ cu. yd. crowned. Body and load are completely spring-mounted, relieving road shock strain when hauling over rough ground.

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## New Sandstone Quarry Near Harrodsburg, Ind.

The Bloomington Sandstone Co., Bloomington, Ind., is opening a new quarry at a point about 2½ mi. east of Harrodsburg, Ind., and 12 mi. south of Bloomington.

# Manufacturers' Publications

*Each publication listed below contains information of interest to nonmetallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention* PIT AND QUARRY *when writing.*

**Boilers**

*Waste Heat Boilers.* Bulletin AB-30-2. 15 p., ill. (Foster Wheeler Corp., New York, N. Y.) A description of the various types of waste heat boilers, their construction and application. Bulletin 150. 8 p., ill. Engineering data on aftercoolers, for cooling and drying air after it is compressed and before delivery to service pipes.

**Cement**

*Incor.* 4 p., 5 ill. (Lone Star Cement Co., Indianapolis, Ind.) Several interesting close-up photographs of new cement work at New Orleans, La., and a description of what was accomplished.

**Compressors**

*Centrifugal Compressors.* 12 p., ill. (General Electric Co., Schenectady, N. Y.) An interesting description, profusely illustrated of various types of blowers and their salient features of construction.

**Concrete Mixing**

*Besser Batch Mixers.* Catalogue. 8 p., ill. (Besser Mfg. Co., Alpena, Mich.) Complete description of the latest models of batch mixers, skip hoists and loaders.

**Conveyors**

*Link-Belt Conveyors.* 176 p., ill. Data Book 1615 (Link-Belt Co., Chicago, Ill.) Contains up-to-the-minute engineering information and suggestions covering the conveyor field in an efficient manner with tables and dimensional data for the operator and engineer.

**Drills**

*Diamond Core Drilling.* 14 p., ill. (Mott Core Drilling Co., Huntington, W. Va.) An interesting booklet giving both history and data on core drilling and a description of some of the machines employed for this purpose.

**Explosives**

*Explosives Service Bulletin.* 4 p. (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) Sixth edition of chart issued for the purpose of aiding users to select explosives giving the best results in proportion to cost.

**Flooring**

*Aerocrete.* 60 p., ill. Technical Bulletin. (Aerocrete Western Corp., Chicago, Ill.) An introduction to the economics and engineering of floors, including technical data and engineering tables.

**Pulverizing Mills**

*Typical Results with Raymond Equipment.* 4 p., Folder. (Raymond Bros. Impact Pulverizer Co., Chicago, Ill.) Gives results obtained in grinding 16 different kinds of minerals in the form of production final analysis.

**Safety Devices**

*Willson Personal Protective Products.* Catalogue No. 29. 31 p., ill. (Willson Products, Inc., Reading, Pa.) Instructive and interesting data on goggles, helmets, respirators and smoke masks. List prices given on all items.

**Steel**

Columbia University Fahralloy Tests. 2 p. (*The Amsco Bulletin* for Aug., 1930. American Manganese Steel Co., Chicago Heights, Ill.) Report by the University testing laboratories of tests made to determine the resistance of Fahralloy to acids, etc.

**Transit-Mixed Concrete Plants**

*Butler Commercial Concrete Plants.* Bulletin 180, 16 p., ill. (Butler Bin Co., Waukesha, Wis.) Engineering data on loading plants for truck-mounted mixers. Bulletin 190, 16 p., ill. Engineering data on Butler central-mixing plants. These bulletins are profusely illustrated and contain much valuable information.

**Wire Rope**

A Well Designed Gravel Plant. 2 p., 6 ill. (*The Hercules Record* for Aug., 1930. A. Leschen & Sons Rope Co., St. Louis, Mo.) A well illustrated description of how raw material is obtained from the Colorado River by hydraulic pump dredge.

## Concrete Made Cellular By Chemical Reaction

Aerocrete, a light concrete building material which rises like leavened bread, has passed the fire, load and water tests required of flooring materials in New York, says *Time.* A Swedish discovery, aerocrete has been used in Europe for a decade to construct building parts which are not subjected to much weight (floor filling, roof blocks). Two years ago, Aerocrete Corp. of America introduced it into the United States and worked with Columbia University's civil engineers to improve the material and make it strong enough to be used as a structural flooring.

Aerocrete is made of Portland cement, sand and small quantities of lime, aluminum powder and soda. When poured out in thick liquid form, the presence of the aluminum powder in an alkaline solution causes a chemical reaction, liberates hydrogen and forms a cellular structure. Within a half-hour after pouring, aerocrete begins to puff up. At the end of an hour, expansion reaches its limit and the material hardens. By varying the amount of ingredients, expansion can be controlled and may vary from 50 per cent to 150 per cent of the original volume.

At Columbia University's fire testing station at Green Point, L. I., the upper surface of a floor of aerocrete 4½ in. thick kept a temperature of 139 degrees to 207 degrees F. during the last hour of a four-hour fire of 1,825 degrees F. blazing underneath. (The maximum temperature of a burning fireproof building averages 1,700 degrees F.) The same floor when cooled resisted a load of 450 lb. per sq. in. with deflections ranging from 0.06 in. to 2 in.

Advantages of aerocrete as a structural floor lie in its high heat-insulating value, its sound-deadening properties, its light weight. According to the use for which it is needed, it can be made from 20 per cent to 75 per cent of weight of ordinary concrete. Authorities expect it to reduce by almost one-fourth the weight of steel necessary to support a building.

## New Corporations

Green River Lime Co., Whitewood, Ky. G. B. Taylor, W. R. Atteberry, C. T. Mullins. $10,000.

Tennessee Marble & Brick Co., Inc., Fayetteville, Tenn. G. A. Jarvis, pres.; J. W. Holman, vice-pres.; R. W. Gaunt, sec.-treas. To quarry limestone. 100,000 shares n. p. v.

Stony Point Sand & Gravel Co., Yonkers, N. Y. A. H. Arnjost. $20,000.

Dixie Sand & Gravel Co., Memphis, Tenn. L. G. Van Ness, B. W. Cohn, J. C. Longon. $25,000.

Clark Quarries, Inc., Fort Collins, Colo. W. R. Clark, I. J. Dilts. $10,000.

C. B. Clegg Co., Greensboro, N. C. To produce crushed stone. $100,000.

Avery Mining Co., Inc., Plumtree, N. C. Harris H. Saunders, W. T. Saunders, Fred J. Fuller, Nashville, Tenn. $50,000.

Batesville Black Marble Co., Batesville, Ark. M. L. Thogmartin. 750 shares n. p. v.

Marus Stone & Marble Co., 747 East 11th St., Chattanooga, Tenn. Paul Maurus, pres.-treas. To produce crushed stone and marble. $30,000.

Fundy Sand & Gravel Co., St. John, N. B., Can. $25,000.

Worcester Transit Concrete, Inc., Worcester, Mass. Richard C. Cleveland, pres.; Roy N. Grout, treas., 182 Commercial St., Worcester; George A. Gaskill. Plant at Auburn. 1,000 shares com. n. p. v.

Douglas Salt Co., Douglas, Ariz. Russell Meadows, M. T. Hammill, C. O. Meadows. $100,000.

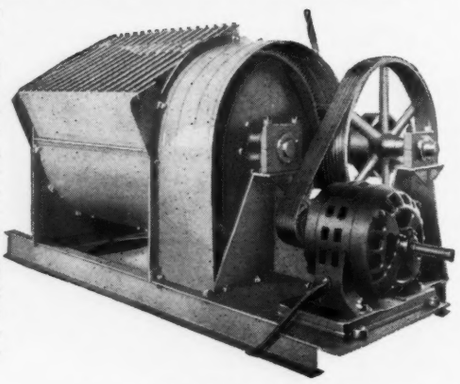
## This Machine Has Started Many Concerns on the Road to Prosperity

Many of the largest concrete products manufacturers realized their first profits with a Besser Master Tamper. Their present size and prosperity are the outgrowths of a small beginning. With your present raw material supply, sales and delivery facilities, you have a running start. Besser Engineers will install equipment and put it in successful operation without charge for service. The concrete building unit market is a growing one and you can make money by taking advantage of it.

## Besser Batch Mixers

**5, 12, 18, 25, 30, 40 and 50 cu. ft. Capacities**

Besser Batch Mixers are noted for thoroughness and speed of mixing, long-wearing qualities and minimum power requirements. Charging and discharging are accomplished easily and quickly. Ask for complete details of Besser Batch Mixers.



**The Seven Divisions of BESSER SERVICE to The Concrete Products Industry**

1. BESSER SUPER STRIPPER. 8 blocks, 16 slabs or tile or 48 concrete bricks per minute.
   BESSER STANDARD STRIPPER. 6 blocks, 12 slabs or tile or 36 concrete bricks per minute.
   BESSER VICTORY STRIPPER. 4 blocks, 8 slabs or tile, or 24 concrete bricks per minute.
   These Stripper Machines make the block on plain pallets and only one set of pallets required for a very large variety of product.
2. BESSER MASTER TAMPER. FACE DOWN MACHINE. 3 to 4 blocks per minute.
3. BESSER BATCH PADDLE MIXERS in Seven Sizes. 5, 12, 18, 25, 30, 40 and 50 cu. ft. capacities.
4. AUTOMATIC CONCRETE BRICK MACHINE. 40 to 50 M per day.
   MASTER CONCRETE BRICK MACHINE. 10 to 20 M per day.
5. BESSER SEWER, CULVERT AND DRAIN TILE MOLDS. All sizes up to 5 ft.
6. CARS, PALLETS, ELEVATORS, ETC.
7. BESSER FACILITIES FOR SERVICE AND ENGINEERING ASSISTANCE.

### Free Engineering Service

Besser Engineers will design and lay out plants with equipment for any capacity production desired—small or large—and will set up machines and start them in successful operation. Estimates on plant equipment gladly furnished. Write or wire.

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Philadelphia—Newark—Dayton—Chicago—Milwaukee
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## "Bristol's Shorten the Job and Make it Permanent"

A broken conveyor belt is never a serious interruption in the mine, mill or quarry that keeps a supply of Bristol's Steel Belt Lacing along the right of way.

No skilled labor is necessary, for any man who can drive a nail can repair a break, rip or split in a very few minutes with Bristol's.

He squares off the ends, butts them together, drives the Bristol's through, clinches them, and once the tough steel claws are hammered flat, the joint will outlast the life of the belt itself.

Bristol's have been used in mines, mills and quarries for forty years. Write for Bulletin 722-O.

**THE BRISTOL COMPANY**

**Waterbury, Conn.**

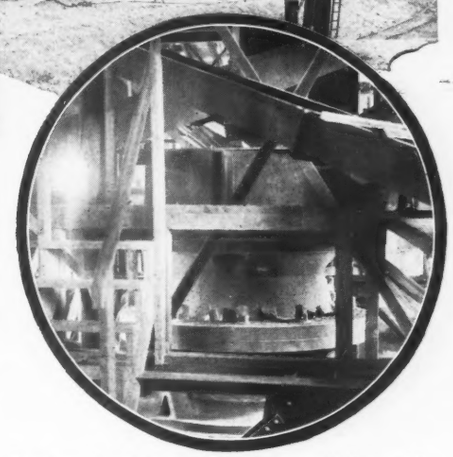
**BRISTOL'S**

PATENT STEEL

**BELT LACING**

*This*

# Plant Sells Both Crushed Stone and Washed Gravel



One of the country's largest . . . the new $350,000 plant of the Van Camp Sand & Gravel Co., near South Lebanon, Ohio, has a capacity of 350 tons hourly. Its two washing screens are arranged in parallel . . . one produces washed gravel; the other, washed crushed stone. Each product is kept *entirely separate* . . . but crushed rock can be run in with gravel when desired. Telsmith designed the plant, in co-operation with Mr. B. T. Van Camp, and Telsmith built most of the machinery.

Air dump cars haul material to an open concrete hopper and two Telsmith Plate Feeders, 30 in. x 5 ft. 6 in., with Timken bearings, feed to a belt conveyor which carries it to a Telsmith rail bar grizzly, 4 ft. x 12 ft. Coarse rock is crushed by a No. 13-A Telsmith, Primary Breaker. Crushed material and under-size aggregate are conveyed to top of plant, to an all-steel, Timken equipped, Telsmith-Hercules Scalping Screen, 72 in. x 23 ft. with 2½ in. perforations. Troughs go to an all-steel, Timken equipped, double-jacketed Telsmith-Hercules Washing Screen, 60 in. x 24 ft., which separates washed gravel and sand. Washer oversize goes to a re-crusher. Scalping screen oversize goes to a No. 52 Telsmith Reduction Crusher (circle inset) and its product is reconveyed to a 60 in. x 25 ft. Telsmith-Hercules Stone Washing Screen (upper left). This screen's oversize goes to the re-crusher.

Steel chutes carry washed and sized gravel to storage silos . . . waste water and sand from gravel screen is flumed to two sand drags and their overflow goes to three Telsmith No. 8 fine sand tanks. Water and fine stone screenings passing ¼ in. holes of the stone screen's outer jacket are flushed to a Telsmith No. 7 Settling Tank.

Designed with a view to simplicity and economy of operation, this plant has shown an unusually high degree of efficiency . . . and Telsmith Balanced Service, which combines sound engineering counsel with quality equipment, was directly responsible for this success.

**WRITE for Bulletin G-15—find out how Telsmith Balanced Service designs and builds your gravel plant and guarantees results.**

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# TELSMITH